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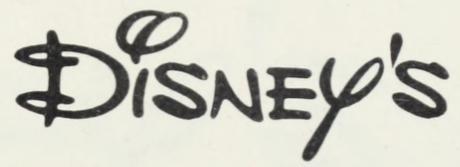
WONDERFUL WORLD OF KNOWLEDGE





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 Disney's

6 | WONDERFUL WORLD OF KNOWLEDGE



\$*Disney's*

Wonderful World of Knowledge



THE DANBURY PRESS



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ROBERT B. CLARKE *Publisher*

ROBERT G. BARTNER *Marketing Director*

GILBERT EVANS *Creative Director*

JACK JAGET *Design*

THE STONEHOUSE PRESS *Production Supervision*

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"Disney's WONDERFUL WORLD OF KNOWLEDGE"
is an updated and enlarged English version of
an encyclopedia heretofore printed in the Italian language by
ARNOLDO MONDADORI EDITORE, MILAN
and entitled (in English Translation) "Disney ENCYCLOPEDIA"

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Printed in the United States of America

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BIRDS IN FLIGHT



Hello, boys and girls, this is Grandma Duck. I'm going to tell you about my trip through the wonderful world of birds. It was a very expensive trip. And would you believe that Uncle Scrooge was the one who gave me the money? But it wasn't easy to get him to do it. First I had to make him see that the study of birds was a good, sound investment.

I pointed out that every year ornithologists (the people who study birds) pay a fortune for the studies of new species of birds. And that if research is done scientifically, 3 or 4 new species can be discovered. So Uncle Scrooge put all of his turbojets at my disposal! However, I was just as happy to settle for a helicopter, a little one—you know Grandma Duck!

But I had a little opposition. From whom? Why from dear Gertrude and Derby and all the others. They just didn't want to let me go. They said I could study birds by sitting on a roof or perched on a tree branch. But I was finally able to get them to change their minds. How? Well, I explained that according to some experts, there are about 8,650 species of birds, 8,548 according to others, and 9,635 according to still others. And not all of these birds are nice enough to fly

over our neighborhood so I can see them.

First stop on the trip I paid a visit to the best experts in ornithology. The very best in all the world. Boys and girls, I learned a great deal. To study bird life in detail, it's not enough to know only the existing species (the kinds of birds around now). You also have to know about their ancestors of millions and millions of years ago. Do you know what I found out? Birds are directly descended from reptiles. The British naturalist T. H. Huxley in the 19th century defined birds as "glorified reptiles." Some zoologists (people who study animals) call them "sublime and exalted reptiles." Speaking as a bird, the idea that my ancestors were reptiles gives me the chills. Anyway let's take a brief look at the structure of a bird—how it is put together.

A bird's structure is very similar to that of a reptile. Of course the bird has developed in a number of different ways. These differences have come about because the bird flies in the air, while the reptile crawls along the ground. When one looks at the wings of a bird and thinks of soaring through the air, the idea of reptile just fades away. At least that is so with me.



A fossil (ancient remains) of an Archaeopteryx. These creatures, which lived some 150,000,000 years ago, were the ancestors of today's birds. They were also related to the reptile family.

Right: A detail of an eagle's wing. Eagles have wide and powerful wings that enable them to fly for long periods of time. They are birds of prey, or hunters, and their keen eyesight allows them to see their prey from a great distance as much as 2 miles away. Their curved claws, or talons, and hooked beaks are used to catch the prey and tear it apart. There are many different kinds of eagles, ranging from the American bald eagle—the national symbol of the United States—to the great golden eagle. The largest known golden eagle had a wingspan of about 8½ feet.

Opposite page, below:
Canaries are popular
household pets.

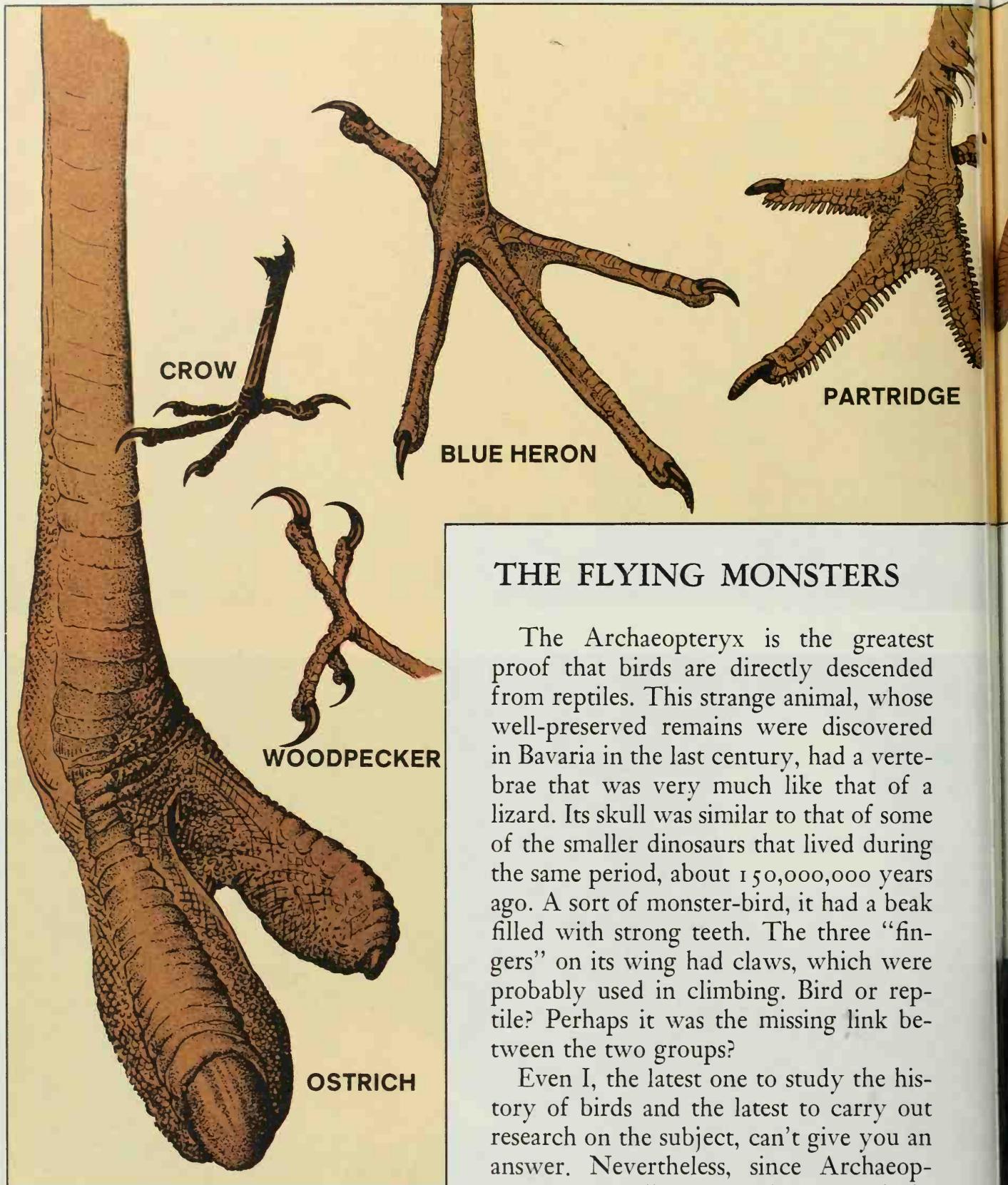


It isn't easy to learn how birds first became able to fly. There are no known fossils of these very early ancestors. Most likely they were small, lightly built, agile, tree-living reptiles. For them the ability to glide a bit and eventually to fly must have been a very great advantage. Flight helped in moving about freely to find food. But the most important advantage was probably the greater safety it brought to small animals.

Before they learned to fly the structure of the birds went through a number of changes. Over the long passage of time their chests and hips joined together to form a strong but light protective armor. The underpart of their bodies took the shape of a keel with muscles attached to it to move their wings.

When did birds become really different from reptiles? We're not sure, but it probably happened during the Mesozoic era, at least 150,000,000 years ago.





The shape and size of birds' feet vary according to their different ways of life.

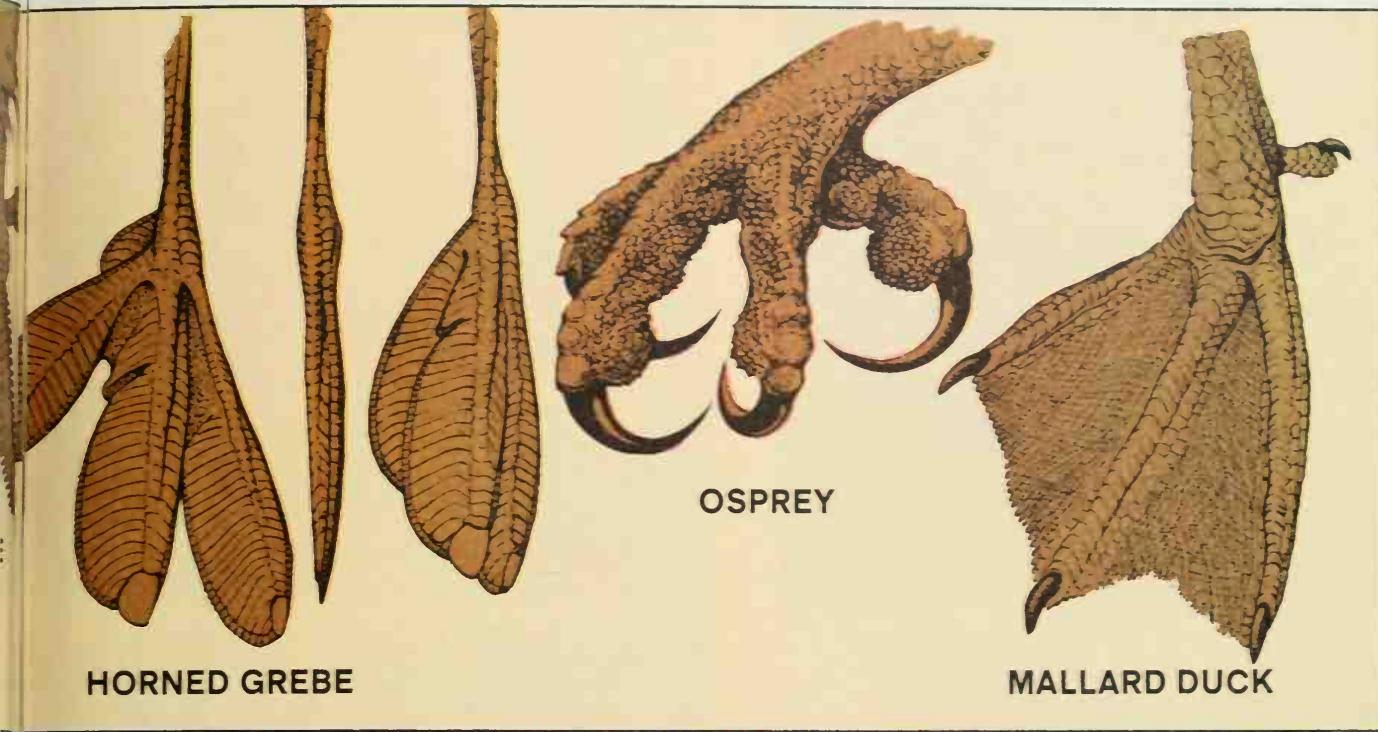
Opposite page, below: The powerful foot of an eagle is ideally suited for catching and carrying prey.

THE FLYING MONSTERS

The Archaeopteryx is the greatest proof that birds are directly descended from reptiles. This strange animal, whose well-preserved remains were discovered in Bavaria in the last century, had a vertebrae that was very much like that of a lizard. Its skull was similar to that of some of the smaller dinosaurs that lived during the same period, about 150,000,000 years ago. A sort of monster-bird, it had a beak filled with strong teeth. The three "fingers" on its wing had claws, which were probably used in climbing. Bird or reptile? Perhaps it was the missing link between the two groups?

Even I, the latest one to study the history of birds and the latest to carry out research on the subject, can't give you an answer. Nevertheless, since Archaeopteryx means "ancient winged one" in Greek, I'm willing to consider it a bird. I must point out that this monster did have perfectly developed feathers.

Maybe I should add that the Archaeop-



teryx lived in the swamps that covered central Europe at that time. It wasn't much of a flyer. We believe it used its wings to help it glide from a high branch in a tree down to a lower one. It ate small invertebrates (animals without backbones). To make a long story short, this "first bird" may be considered an agile lizard with feathers.

As to the other birds that came along in the following eras, we know of some 2 dozen types. Let me tell you about the Hesperornis. The Hesperornis was a large swimming and diving bird that seems to

have lived mainly in the water. Its legs were located far back on its body. The feet were very large, paddle-like, and completely adapted for swimming. Hesperornis could probably not walk very well on dry land. It may have come out of the water in order to lay its eggs.

There was also the Diatryma, which lived about 60,000,000 years ago. It's very likely that, like the ostrich, it couldn't fly.

Well, it's time to leave the past and fly into the present. Let's go. The helicopter is ready!





The warbler finch is one of the 14 species of finches that live in the Galápagos Islands, off the west coast of South America.

AN ENGINEERING MASTERPIECE

I'm flying along at a wonderful speed, simply enjoying myself. Ah, here comes a bird into view. How gracefully it flies. How it swoops and then spreads out its great wings and glides. Boys and girls, being able to closely watch a bird in flight is a lucky break. If you ever get the chance to do as I'm doing, you'll see how every part of the bird's body is used in flight. It's truly a miracle. When I talk of birds floating on the shining air, my breath comes in gasps. Grandma Duck becomes young again. How I would love to just soar up into the sky. Of course, I like sitting comfortably in a helicopter. But to be able to soar on your own wings. . . . Boys and girls, do you know there are almost as many shapes of wings as there are kinds of birds?

The wings of the pheasant or partridge are short, broad, and rounded. They are well suited for short bursts of rapid flight in wooded or brushy country. The wing of the albatross is long, narrow, and pointed. It is well suited for almost effort-

less flight in strong ocean winds for days on end.

When I think of wings I immediately think of feathers. For feathers cover wings, don't they? And these very wing feathers help a bird to fly better than say, for example, a bat that does not have these feathers. Examine the next feather you come across. This marvel feels almost weightless. Yet run your finger along the feather's edges and see how strong and flexible it is.

Birds periodically loose their feathers, or molt. In a way they change their clothes with the change of season. In spring some birds strut about in their new wedding clothes. How brilliant they look when they court each other. Do you know that even Grandma Duck was courted during her happy younger days? Bet you never imagined that.

When birds molt they don't lose all of their feathers at the same time. In this way the bird is still able to fly. But geese, ducks, and other aquatic birds, which have less need to fly in order to find food, molt all their wing feathers at the same time and cannot fly for a short period. But now, let me tell you about the marvelous eyes of birds.





The largest order of birds is called the Passeriformes. It includes more than half of all living birds, and is widely distributed around the world.

Opposite page: The American blue jay can be found in all the temperate regions of the United States.

These birds live mainly in forests, but they can also adapt to city life.

Top, left: A pair of cedar waxwings. Cedar waxwings are fairly small birds, usually about 8 inches long.

They live in the northern parts of the United States, Europe, and Asia.

Top, right: The goldfinch, which is known for its cheerful song, is another bird that is found in most of the nations of the world. Its main food is seeds, especially those of the thistle and related plants.

Above: The European blackbird is a member of the thrush family. It is not related to the American blackbird.



A BIRD'S EYE VIEW

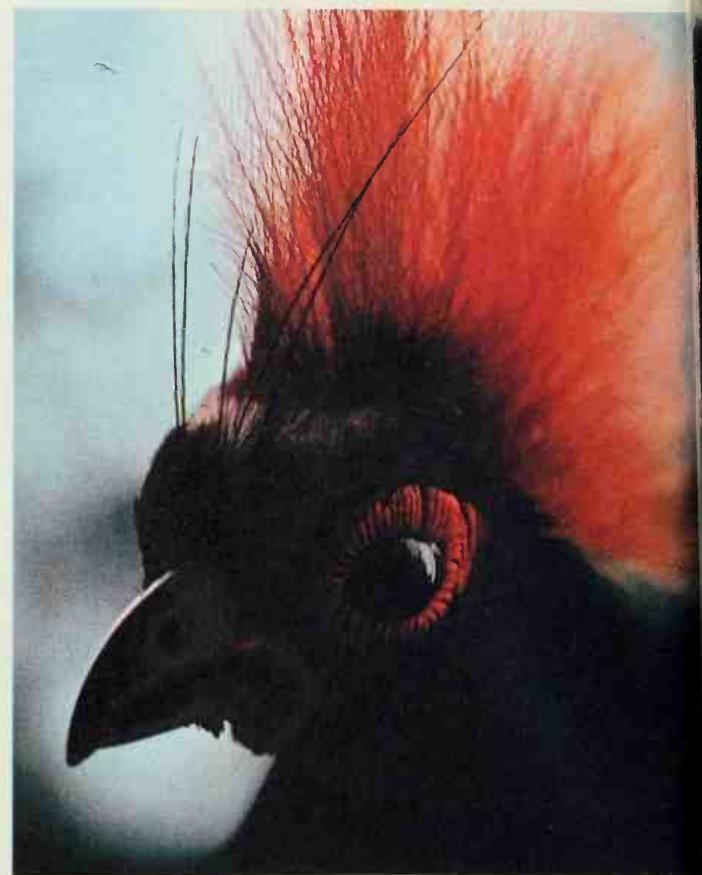
Fine eyesight is vital for a flying animal. It is one of the most important features of birds. If, when you look at a bird, you think that it has small eyes, you would be wrong. In proportion to the size of the animal, the eyes of a bird are much larger than those of most other backboned animals. The eye of the ostrich measures $2\frac{1}{2}$ inches in diameter—the largest eye of any living land animal regardless of the animal's size. A bird's ability to see both near and far is extraordinary. A robin redbreast on the alert for an enemy approaching from a far distance can focus almost immediately on an insect flying just a few inches away from it.

Birds that are active during the night have their eyes set in front of their heads. These birds have a wide field of vision, making them excellent judges of distance. It also makes it easier for them to see and hunt moving prey.

The woodcock's eyes are placed on top of its head. This allows the bird to see even when the bill is pointed downward while searching for worms. Many times boys and girls ask me about birds and color perception. As far as we can tell, the ability of birds to see color is somewhat like that of a human being's.

FROM HEAD TO FOOT

The beak, too, plays an important role in the lives of our bird friends. With its beak a bird can pick, tear, and handle the different objects with which it comes into contact. In many cases, the beak is used as an instrument—as a hammer, a scissors, a nutcracker, and so on. It is also used to arrange plumage, build a nest, and feed



Above: This rare bird lives in the dense tropical jungles of Sumatra, in Indonesia. It is known for its bright scarlet crest and rhythmic call.

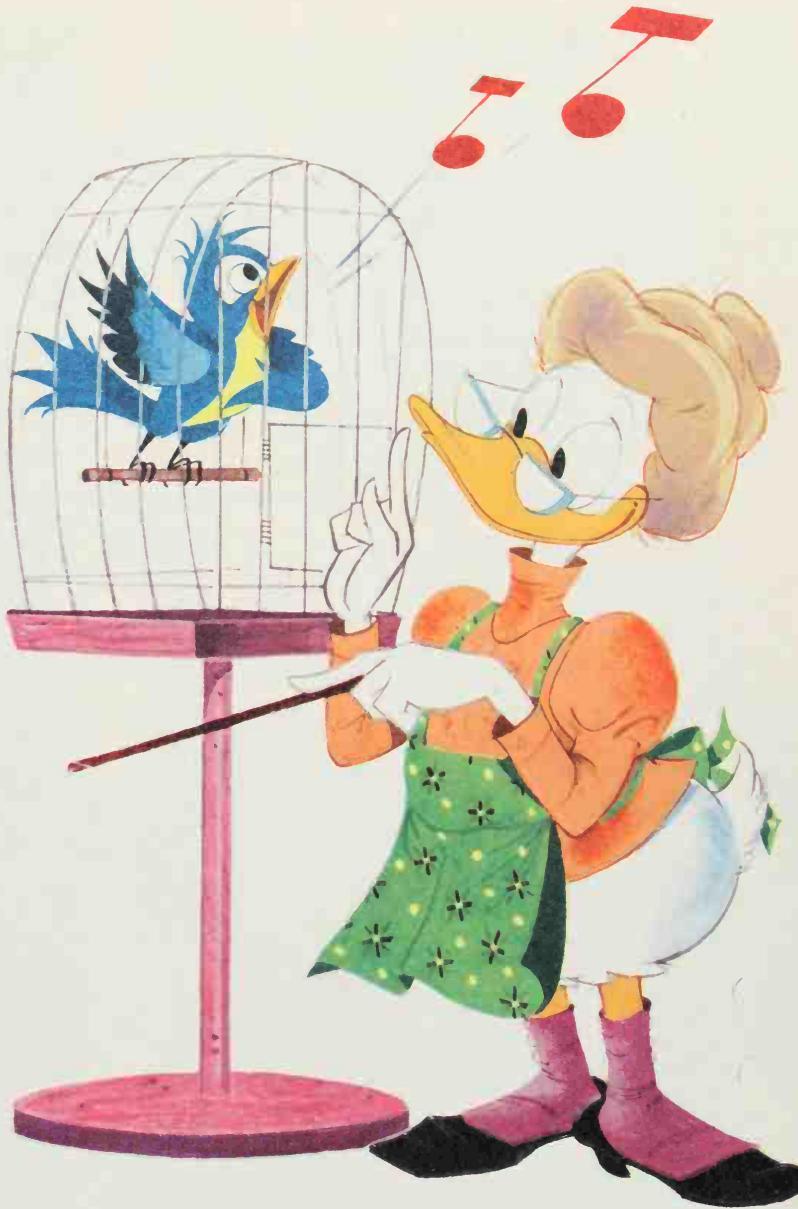
Below: Because of their beauty and graceful movement, doves are considered the prettiest members of the pigeon family.

Opposite page: A European cuckoo. These birds, which were named for the sound they make, sometimes lay their eggs in other birds' nests.





the little ones. There are many different kinds of beaks or bills. For example, the red crossbill has a heavy seed-eating beak. The tip of its upper mandible, or jaw, curves over the tip of the lower mandible. This kind of bill makes it easy for the bird to pry seeds from the evergreen cones. The shrike has a stout, hooded beak suited for grabbing large, hard-bodied insects or even a young bird. The duck has a bill, or beak, which it uses to scoop water. Just imagine the strength and precision of the woodpecker's beak, that most efficient drill for tree trunks. Think of the hard and curved beak of a parrot that it uses when cracking the



hardest of shells and nuts. I'll stop with these few examples, but I'm sure that you can think of many others.

Now let's take a look at the feet of birds. A bird uses its feet in order to climb, to run, to cling, to scratch, to wade, to swim, and to catch its prey. Eagles, hawks, and owls have very strong feet. These birds of prey have sharp, curved claws on all four toes. An eagle finds it pretty easy to seize a small animal with its feet and carry it up and into the sky. The short webbed feet of ducks are just perfect for swimming. But Uncle Scrooge uses his for counting his dollar bills!

TIME FOR DINNER

And here we are, at last talking about food! As you know cooking is my favorite pastime. But now I shall have to talk about foods that are quite different from my tasty old recipes. No matter, Grandma Duck will deal with the subject with her usual enthusiasm.

Well, to begin with, you must know that practically anything that can be eaten is included in a bird's menu. Sea gulls and vultures will feed on the leftovers of a whale carcass. Flamingos will pass up such a meal if it is at hand. They would rather search high and low for tiny sea-



weeds. Wherever there are things that grow or have lived, there you will find birds. Where these elements do not exist, as in some deserts and in the heart of the polar regions, you will not find any birds.

It is believed that Passeriformes, which feed on flowers and seeds, have grown in numbers along with the increase of vegetable life. Passeriformes are the most important group of birds. There are about 6,000 species of Passeriformes out of a total of 8,650 living species of birds. This



Opposite page, top: The buzzard is a bird of prey. It resembles the eagle but it is smaller and cannot fly as fast.

Buzzards eat small animals and reptiles.

Opposite page, below: The prairie falcon, also a hunting bird, is a member of the hawk family. Like most hawks, its legs and feet are not feathered.

Left: The Philippine monkey-eating eagle is one of the rarest members of the eagle family. Today there are so few of these eagles left alive that the species is in danger of becoming extinct. Named for their favorite food, these birds live in the tropical forests of the Philippines.

Below: The golden eagle. Like most birds of prey, golden eagles can be trained to hunt at human command and to return their catch to the trainer.



reminds me of something that is important to all of us. And I want you to pay close attention to me as I talk about birds and insects.

I'll start by saying that if it weren't for the birds, the world would have a lot of trouble from insects. Do you know that there may be over 1,000,000 species of insects? The overwhelming majority of the bird families are insect-eaters. This is why so many scientists and nature lovers are against any form of bird ex-

termination. They say do not kill off the birds. Because if you do after a while you're going to find out how wrong you were. There'll be a breakdown in the balance of nature. These scientists and nature lovers have said this over and over again. Well, there's a lot more to this important subject. There are those who point out that birds eat insects useful to man. The birds cannot tell the difference between the harmful and the useful insects. So there you are!





Opposite page, left: The griffon vulture is one of the largest of the birds of prey. All vultures are carrion birds. This means that they eat only animals that are already dead. Griffon vultures live in the mountainous regions of southern Europe, North Africa, and Asia.

Opposite page, right: The harpy eagle lives in the forests of Central and South America. These vicious birds of prey attack monkeys, rodents, and other birds. Harpy eagles are known for their shrill, high-pitched call.

Opposite page, below: Chanting goshawks, which can be found in East Africa, live and hunt in grasslands and semidesert regions.

Above: The king vulture, which also lives in Central and South America, is one of the most colorful birds of prey.

Right: The Bateleur eagle of Africa lives mainly on reptiles. In spite of its short tail, it is capable of long periods of flight.

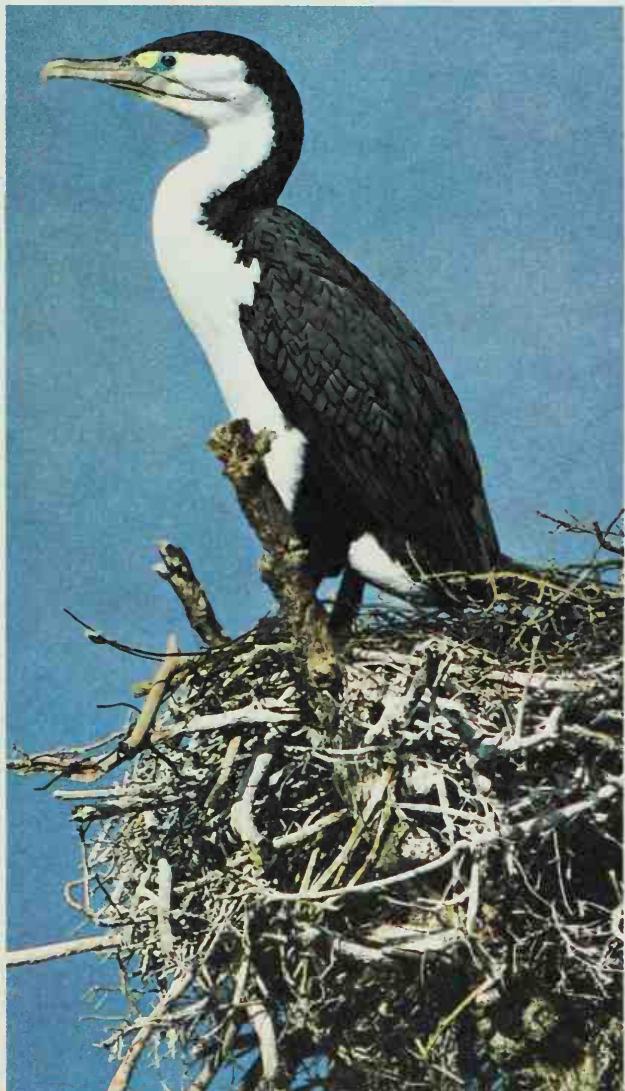
But let Grandma Duck answer these critics. It is true that birds do not know how to choose, but it is also true that no insect is always useful or always harmful. Actually insects only become dangerous to man when their numbers go over the danger mark. Then the birds, instead of eating the less numerous and juicier insects, go after the more numerous ones,



thus re-establishing the balance of nature.

A VARIED MENU

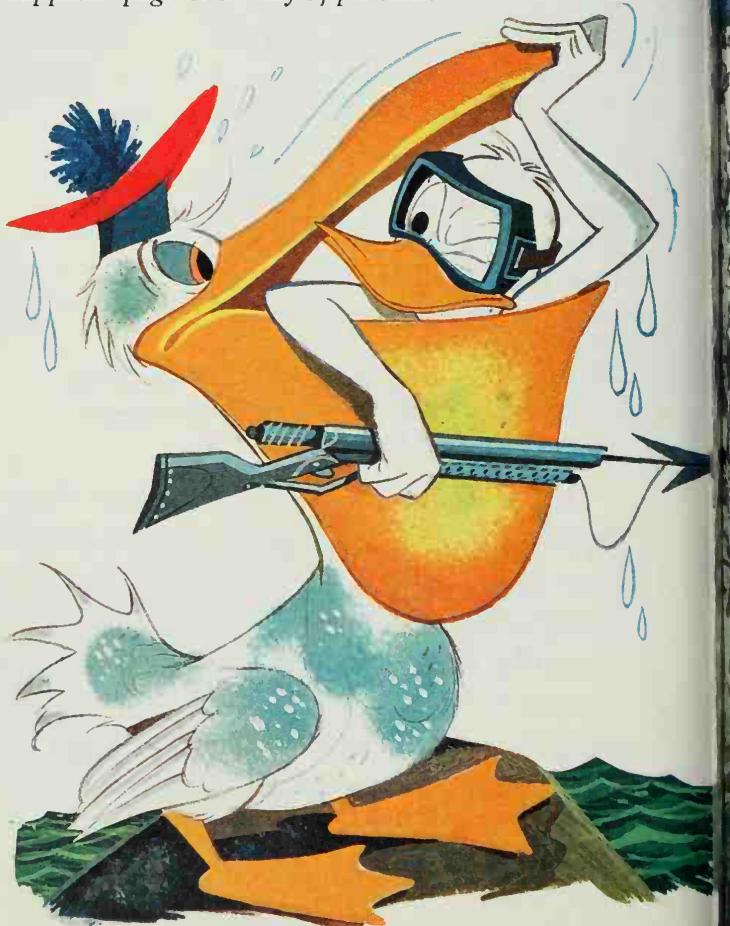
Every bird generally has a food preference. Different kinds of birds living in the same area rarely come into conflict with one another over food. In the woods you



Above: Only about 300 New Zealand king cormorants still exist today. Cormorants catch fish by diving below the surface of the water. No one really knows why cormorants spread their wings after leaving the water. It may be to dry them, or it may be for better balance on land.

Left: An Australian cormorant.

Opposite page: A colony of pelicans.

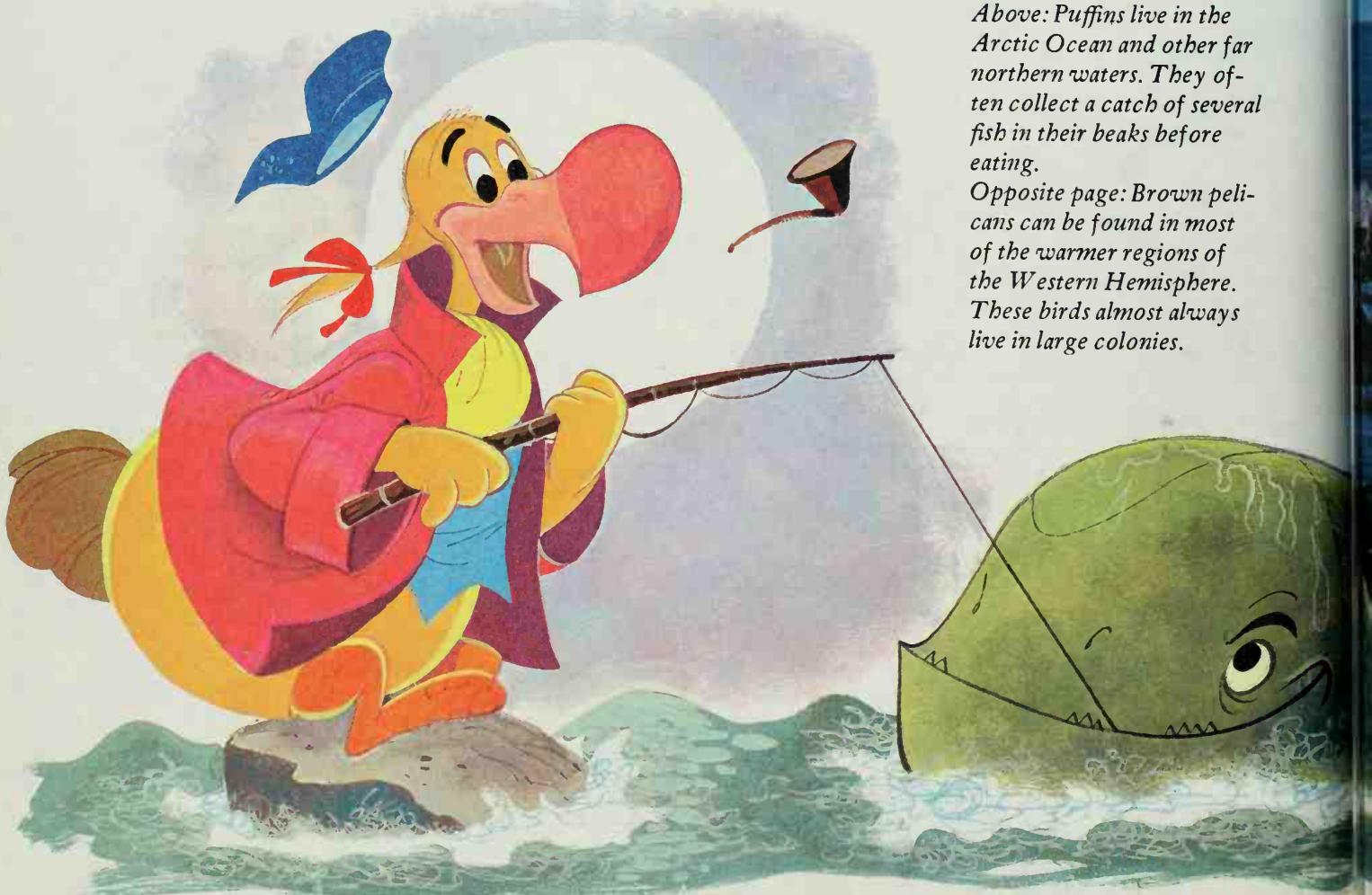
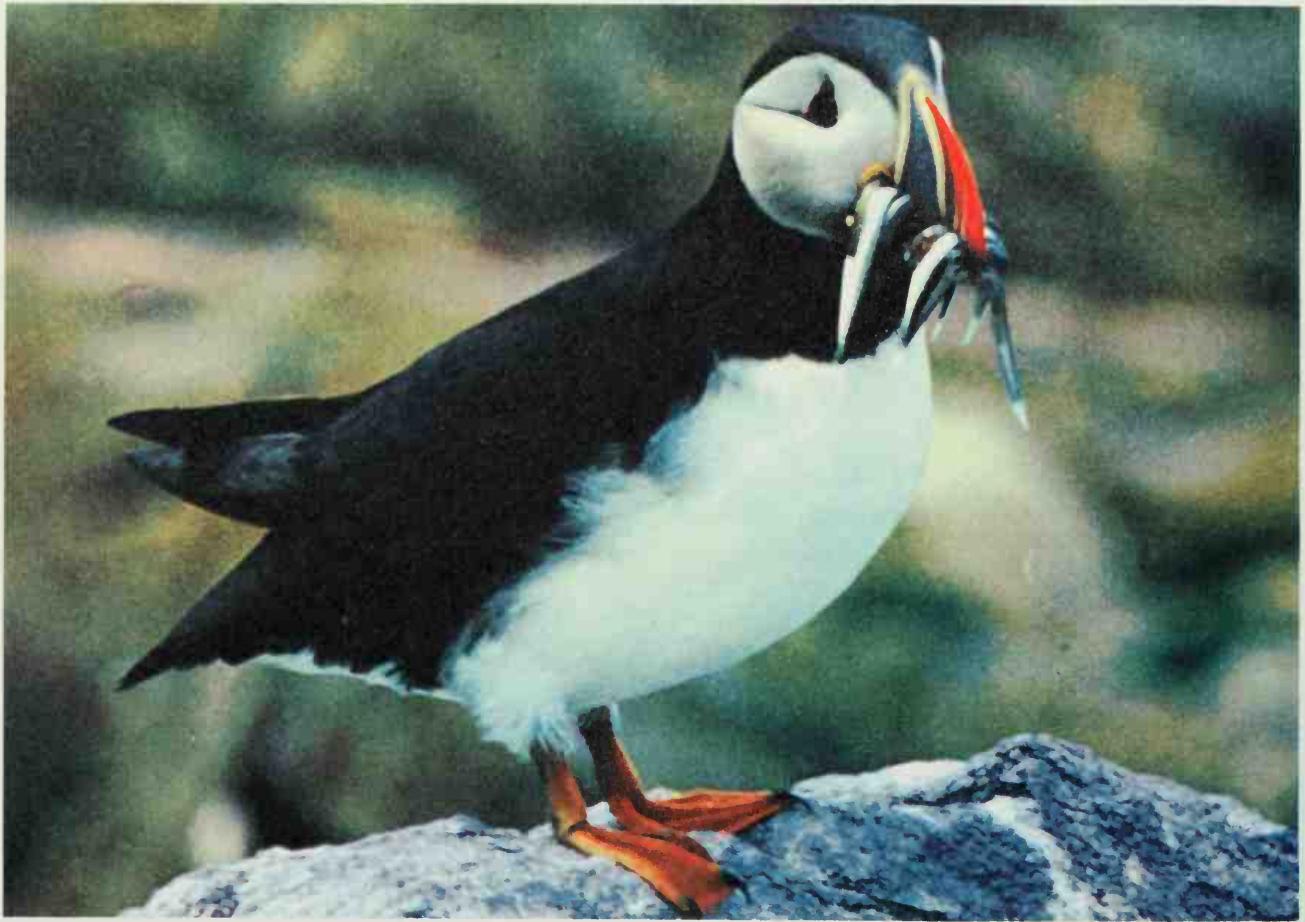


may come across green woodpeckers or great redheaded woodpeckers hunting for food up and down tree trunks. They do this without seeming to care about other birds pecking around them among roots and leaves or on tree tops. You can put sparrows, flickers, and geese together and they'll all go about their business without bothering one another. The sparrows will eat the seeds, the flickers the ants, and the geese will graze on the grass.

This rule of not interfering with one another is broken only when there is sud-

denly great abundance of a certain kind of food. I remember one time, oh, some 10 years ago . . . or was it 20 years? . . . You see what can happen to the memory of an old duck! But never mind. It happened and I saw it happen. Where there had been very few locusts, suddenly the whole area was filled with them. And then something strange happened. Birds from all over, birds of many different kinds, came flying into the area. And they ate up as many locusts as they possibly could. Now what do you think of that?





Above: Puffins live in the Arctic Ocean and other far northern waters. They often collect a catch of several fish in their beaks before eating.

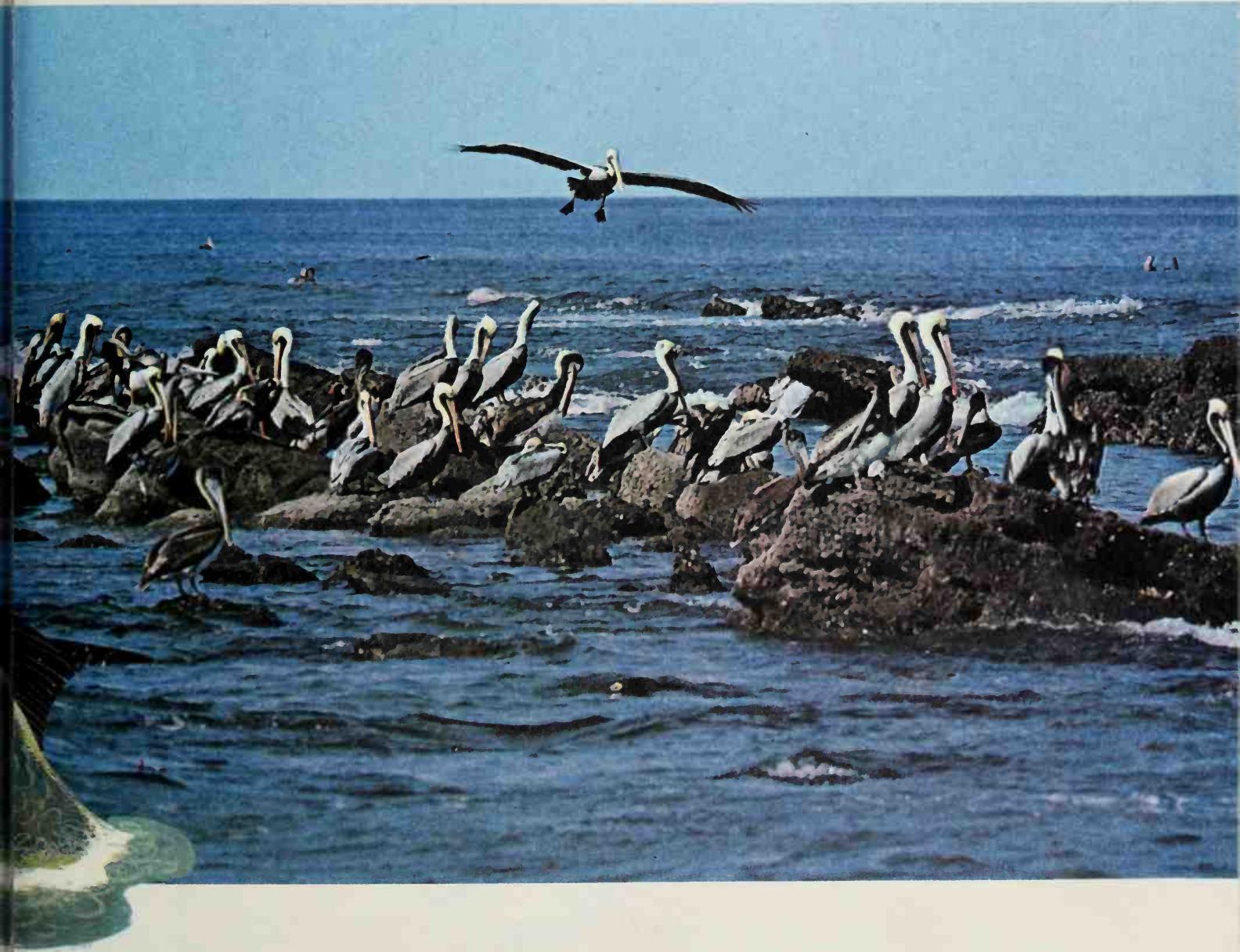
Opposite page: Brown pelicans can be found in most of the warmer regions of the Western Hemisphere. These birds almost always live in large colonies.

Talking of locusts reminds me that there are some scholars who believe it is possible that at one time all birds were carnivorous (flesh-eaters). How do they arrive at this conclusion, you might ask? Well, these bird experts point out that even today vegetarian birds feed their little ones with worms, spiders, and other insects.

I find that when we talk about birds and their eating habits a lot of fine memories come crowding into my mind. I remember meeting some beautiful birds that love to feed on flower nectar. This is easily understandable when you consider that they live in tropical regions where there are flowers all about them—

flowers that grow all through the long year. I also remember visiting birds that live near huge bodies of water. The most spectacular aquatic bird colonies are to be found along the western coast of South America. Along this coast are millions of cormorants, pelicans, and other kinds. They fly here because of the great abundance of fish in the coastal waters.

During my trip I was able to fly over these areas once again and to see once more the great mass of birds. When these birds sweep up into the air all at once, they almost block the sun from view. By the way, pelicans are magnificent divers. It is fascinating to watch them dive headlong, down, down into the churning sea.





SMART EATING

You will probably think that I am lingering on the subject of food because I know so much about it. But I must readily confess that old Grandma Duck always had a tremendous interest in food. I get a lot of enjoyment just from talking about it. And it's interesting in more ways than one. For instance, how birds go about getting their food reveals a great deal about their characters. Let me give you a few examples.

A real smart fellow is the acorn wood-pecker. It drills holes into the trunks of trees and then uses the holes to store acorns and other large nuts. The wood-

pecker is smart in another way. It gets food by sucking sap from holes that were already made by a fellow woodpecker, the sapsucker. And then there's the white-tailed eagle, a true pirate. It robs the petrel when the petrel is on its way back from fishing. There is also another clever fellow, oh, so clever—the widgeon. The widgeon, a freshwater duck, is not a good diver, but the tufted duck is. The widgeon likes the wild celery that the tufted duck spends a good deal of time diving for. So it simply waits around on the water for the poor duck to come to the surface and grabs the celery all for itself. It doesn't seem right, somehow. But that's life.



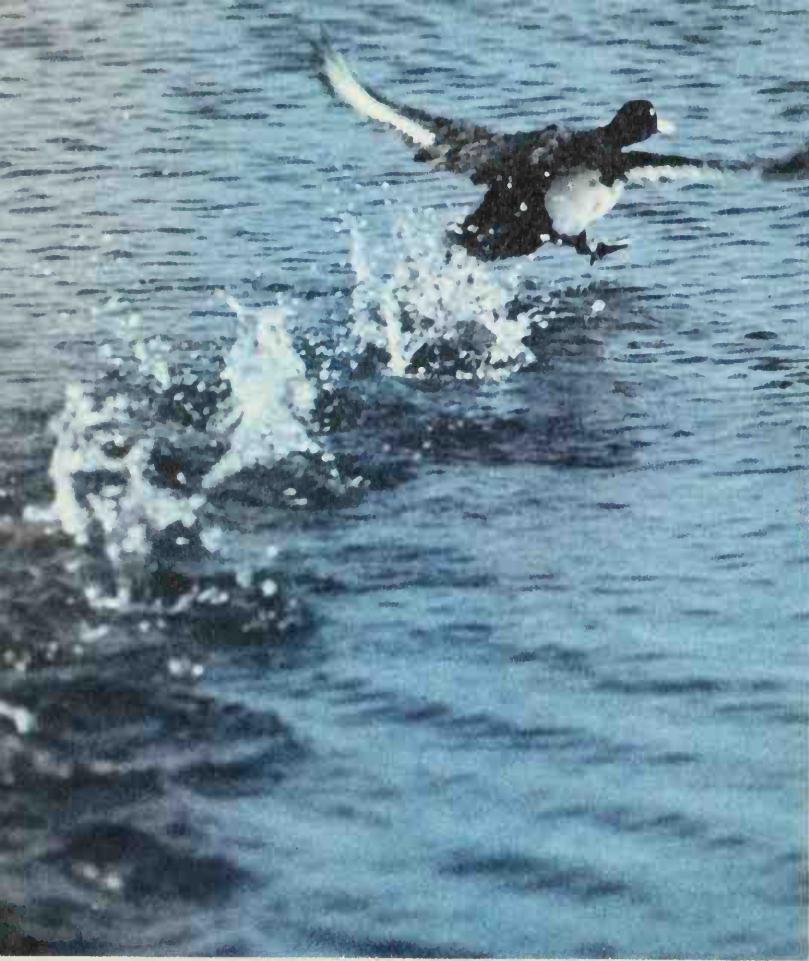
Left, above and below: Gulls are migratory birds and can be found almost everywhere, except in true desert areas and in the coldest parts of the polar regions. Though they are usually referred to as sea-gulls, many species of gulls live far inland, near rivers, lakes, and marshes. Gulls hunt, breed, and migrate in huge flocks. They are long-lived birds—scientists have observed a herring gull that lived to be almost 30 years old. Gulls prefer fish and shellfish, but they will eat almost anything and often follow ships and ferries for considerable distances, waiting for any scraps that may be thrown overboard. Inland gulls usually eat insects, worms, and snails.

Above: A male mandarin duck. These birds live in Japan and elsewhere in eastern Asia. They are often raised as pets, because of their lovely plumage.



Opposite page: This herring gull chick pecks at the red patch on its mother's bill in order to ask for food. The mother gull has stored food in its crop—a pouch inside its throat—where it has been partly digested.



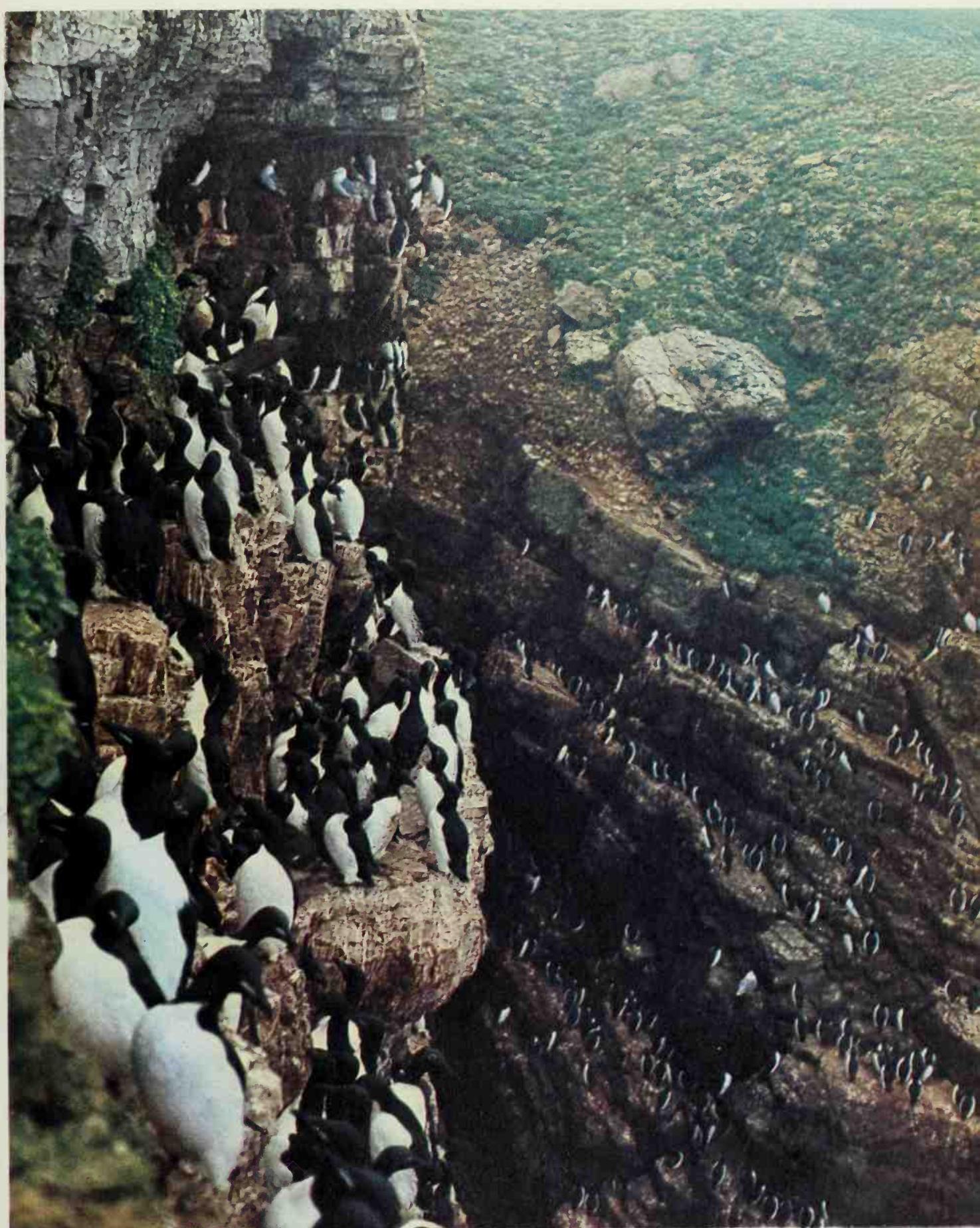


Top, left: A greater scaup takes off from water by flapping its wings and "running" along the surface. Scaups are North American freshwater birds, and they belong to the tribe of ducks called dipping ducks. They find food in shallow waters, paddling with their feet, and always keeping their tails above water.

Above, left: Frigate birds are also known as "man-o'-war hawks." They catch their own fish, but they also attack other birds to make them drop their food. Sometimes they eat the young of other species, and even their own chicks.

Above: A black swan and its chick. These elegant birds, with their graceful shape and bright beaks, were first seen in Australia in the 17th century. Today the black swan is one of Australia's national emblems.

Opposite page: A colony of thick-billed murres. Murres are related to penguins and auks. They live in Arctic and other northern waters. Murres lay their eggs on the ledges and crags of rock cliffs.



WHY BIRDS MIGRATE

My helicopter was nearly overturned by a flock of storks. They came right at us and then just at the last instant divided and flew over and below us. Whew! That was really too close for comfort! I was sure I saw the leaders of the flock grinning at me as they passed by. I guess they got a kick out of scaring old Grandma Duck. Can you guess where those storks were going? They were heading south to escape the cold and snowy winter weather. They were doing what millions and millions of birds do every year—migrating to a warmer climate.

The mystery of bird migration has puzzled and fascinated man from almost the beginning of time. I've done a lot of reading on the subject and so I'm full of information. I've even read the very sacred texts of the ancient peoples. They



Above: The blue titmouse is a small songbird that lives in North America, Europe, and parts of Asia. Titmice eat insects and nuts. They crack the nuts by striking them with their bills.

Below: These nightingales are trying to stop the cuckoo from laying its eggs in their nest.

Opposite page: Touracos are small African birds that are known for their colorful plumage.

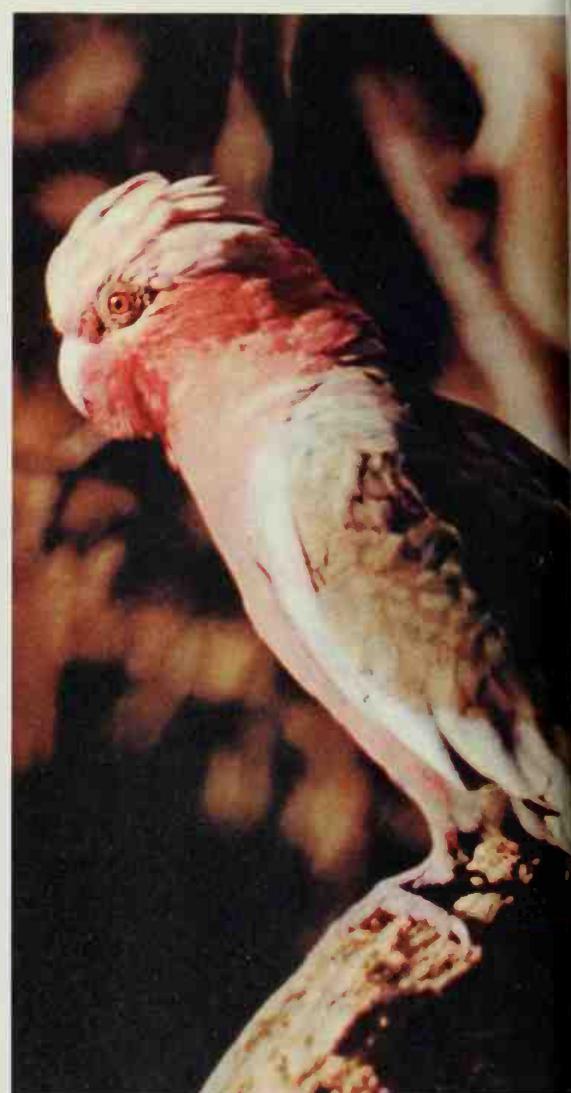






tell how in some temperate regions many kinds of birds vanished in autumn and how with the coming of spring the birds reappeared. This puzzled them and filled these ancients with wonder and awe. Why did the birds leave? Where did they go? How did they find their way to their destination, and how did they always find their way back? The ancient wise men came up with many different explanations and theories. But they did not solve the puzzle.

In the time of Aristotle, the great Greek philosopher, the wise men believed that some birds went into hiding in the vast swamps. They went there in order to keep warm. But Aristotle came closer to the truth when he said that with





Opposite page, left and center: A pair of lorries, small, brilliantly colored parrots native to Australia and Southeast Asia. Most have bristled tongues that enable them to drink liquids and to catch small insects. Opposite page, right: The rose-crested cockatoo, of the parrot family, is also native to Australia. Above: A bright green macaw. These parrots live in the South American jungles.



the coming of the cold weather certain species of birds always fly to the warmer countries.

In the Middle Ages there were many new theories about bird migration. The Emperor Frederick II of Swabia was a scholar and a great expert on birds and their habits. His treatise on falcon hunting included some surprisingly modern theories on migration. But still the mystery was not solved. In the following centuries naturalists expressed views that can only make us smile today. For example they suggested that smaller birds migrated by traveling on the backs of their bigger



Top: The black-hooded parakeet is one of the hundreds of species of parakeets that live in the forests and jungles of South America. Parakeets are usually smaller than their close relatives, the parrots, and not quite so brilliantly colored. All members of the parrot family are long-lived, and 50 is not an unusual age for them.

Above: Two solemn red-and-green macaws. These parrots can be found in many of the countries of South and Central America. Because of their strong beaks, they have been nicknamed "flying nut-crackers."

Opposite page: A lesser bird of paradise displays its bright plumage. Birds of paradise are known for their long, silky feathers. All of them live in Australia, New Zealand, and nearby Pacific islands.



brothers. They also claimed that birds migrated to the moon.

Today, although some details are still not clear to scientists, it is now possible to get an idea of how and why migration takes place. It has been estimated that a great majority of all bird species go through some kind of migration. The phenomenon is greater in the Northern Hemisphere, which has more land surface than the Southern Hemisphere. This huge area becomes cold and uncomfortable during the winter months.

During the short summers the Arctic tundra offers great expanses of land to many species of birds. It is a land that is abundant with food. But with the end

of summer many of these birds are forced to migrate. They then travel to the Argentine pampas or to the immense savannas of Africa. This way, moving from one place to the next, they live in one long summer and never get to know the bite of winter frost.

For the same reason birds that nest in the southernmost part of the Southern Hemisphere travel northward during the long winter months to escape the cold. A few sea birds migrate across the equator. Only the tropical birds and the birds that are particularly suited for the polar climates live in the same area the year round. And even these birds at times move around in search of food.



Opposite page: A male lyre-bird spreads out its delicate feathers during its courtship dance. Lyre-birds are native to Australia. They were named for the shape of their two outer tail feathers, which resemble that of the lyre, an ancient harplike instrument. The central feathers fan out in a screen that almost hides the bird's head. (You can see its eye peering out below the bottom fringed feather.) Lyre-birds are also known for their ability to mimic the calls of many other species of birds.

Right: The bright scarlet king bird of paradise is one of the smallest birds of paradise, and one of the rarest. It is found only in New Guinea, in the Pacific. These birds eat fruit, insects, and sometimes even young birds of other species.



Left: A pair of white storks guard their nest. Storks usually remain mated for life, and they return to the same nest year after year, repairing it as necessary. Sometimes they do this so often that the nests grow topheavy and are in danger of falling. In many European countries, a stork's nest on a rooftop is considered a sign of good luck.

Opposite page, above: The sacred ibis was worshiped as a god in ancient Egypt. Today these ibises can be found only in Africa, south of the Sahara. They are wading birds and catch fish and insects with their down-curved bills.

Opposite page, below: Scarlet ibises once lived in huge colonies in much of South America. But hunters almost wiped out the species, and they are now protected by law to insure their survival.





A BUILT-IN COMPASS

I must admit that I would love to follow a flight of birds in migration. You would too? Well it would probably be an unforgettable trip and maybe a bit rough. Let's talk some more about birds and their migratory routes, or as they are also called, flyways. But first let me tell you that some birds migrate only short distances. A chickadee, whose nest is on the mountain slopes of the Rockies, simply picks itself up and then drops down into a sheltered valley for the winter.

Other birds may fly tremendous distances to escape the oncoming cold. A

bird famous for its migratory habits is the Arctic tern. This incredible traveler flies at least 22,000 miles each year! The tern leaves its nesting grounds in the Arctic and then makes its journey all the way down to Antarctica. Then, believe it or not, it flies back the long, long distance to its Arctic home.

Birds like the Arctic tern seem to follow fairly definite routes, or flyways, on their long trips. What has remained at least partly a mystery to scientists is this: How do the birds find their direction? How do they keep on the correct course for such great distances year after year? Many studies have been made. It appears that birds are able to judge the correct course from the position of the sun and the stars. Another theory suggests that birds have an "internal" compass that responds to the earth's magnetic field.

Now how about me? I wish you wouldn't ask old Grandma Duck that embarrassing question. Although I am a bird, I would rather not discuss my own sense of direction. Why not? Because I just don't have one, so let's change the subject!

THE FAMILY GROWS

I'd like to talk to you now about how birds reproduce. All birds are hatched from eggs. It is the female of the species that lays the egg. Generally the eggs are deposited in a special structure, which is the nest. In some instances the nest is nothing more than a hollow or recess in the ground that has been roughly adapted for the purpose. Often the nests of birds are truly works of art. Various materials, such as lichens, grass, mud, feathers, leaves, animal fur, and twigs, are used in nest-building.

The hatching of the eggs is usually the

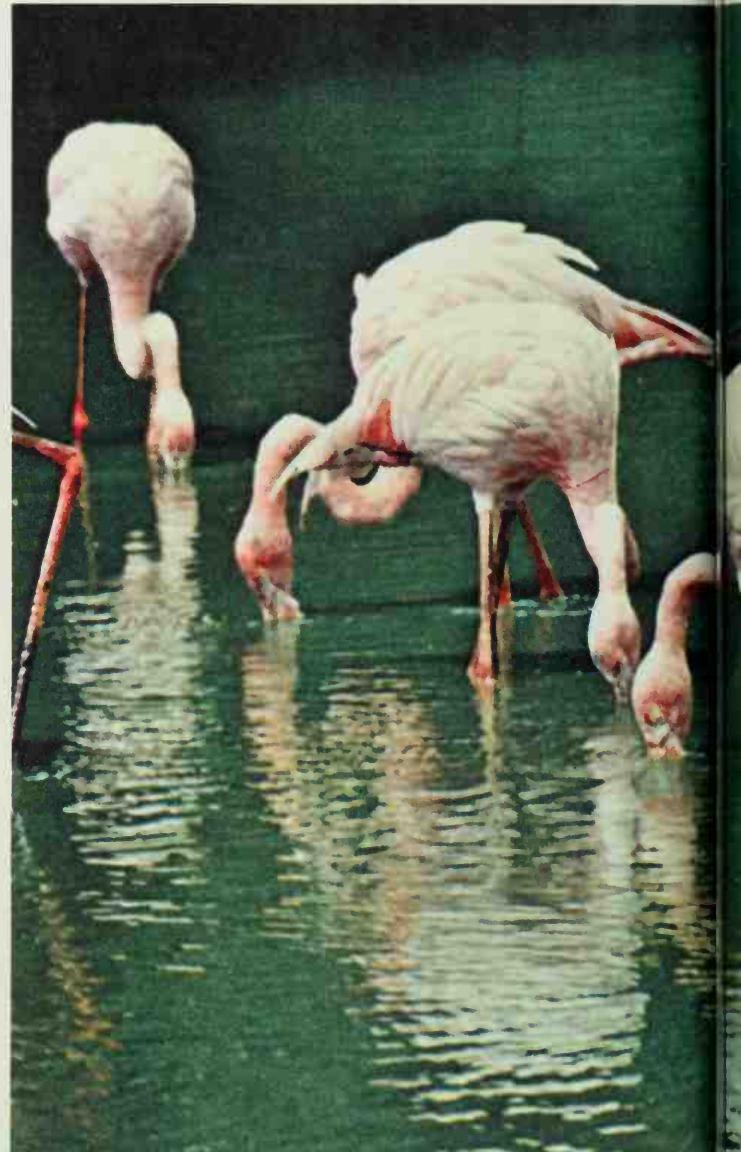
female's job, but in many cases both parents cooperate. Only rarely does the burden fall on the male or on a member of another species. In order to hatch the egg the bird sits on the egg to keep it warm. During the hatching period, many birds lose the feathers on their abdomens. These areas of bare skin are particularly abundant with blood vessels. Therefore they are warmer than the rest of the body and transmit the warmth that is needed to hatch the egg.

An unusual heat-producing system is used by the Megapodes (the mound builders) of the Australia-New Guinea and Borneo-region. The females of the spe-

cies lay their eggs on a heap of leaves and cover them with more leaves and sand. The rotting and decaying leaves give off the heat that is needed for hatching. Every so often the male puts his beak into the mound to find out if the temperature is suitable. Many species of ceculidae, honey-guides, some American cowbirds, and one kind of duck (a very distant cousin of Donald's and mine) lay their eggs in the nests of other birds. They then leave the hatching to these birds. Sometimes the adoptive parents care for only the new birds and ignore their own brood. But other times they look after the entire lot.

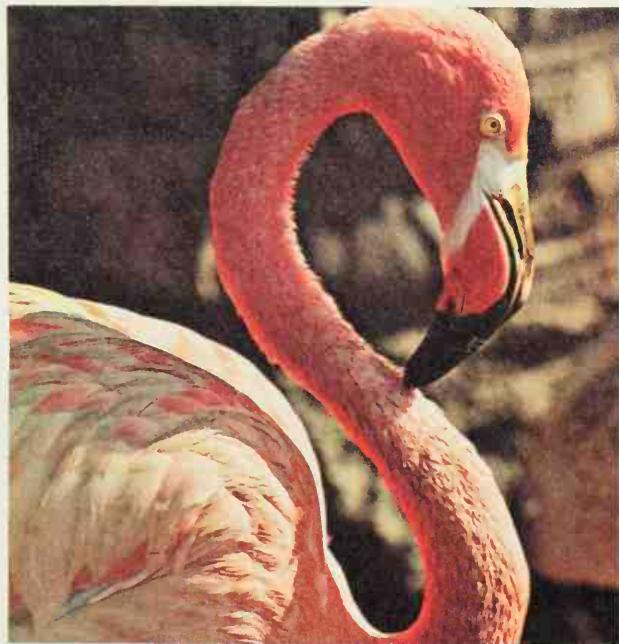


Above: The American egret in flight. The neck folds gently onto the shoulders in an s-shape, and the legs trail gracefully behind. The egret is found along the shores of the Gulf of Mexico and Florida. It is known for its fine plumage.



THE MASTER SINGERS

At this point I nearly had an accident! I was so busy with the birds I forgot to watch the dial controls. The fuel tank was just about empty. Whew! Old Grandma Duck thought that her end was surely here. I just barely had time to land in a large field. Well, boys and girls, it all turned out for the best. While waiting for fuel I decided to rest under a tree. Oh my, how I enjoyed the singing of the birds! It was a lucky break, for my unplanned stopover turned out to be useful and enjoyable. I soon realized that the song of birds is extremely beautiful and



Above: The greater flamingo, one of the world's most beautiful birds, is the owner of an unusual beak. The curve of the beak allows the flamingo to sift through water and mud in search of food. Left: A colony of flamingos wash and drink in a shallow lake.



quite unforgettable. I found out that each kind of bird has a song all of its own and that birds make other sounds too.

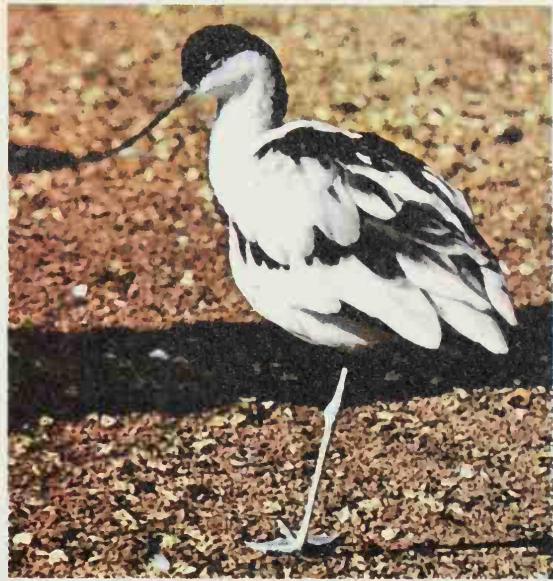
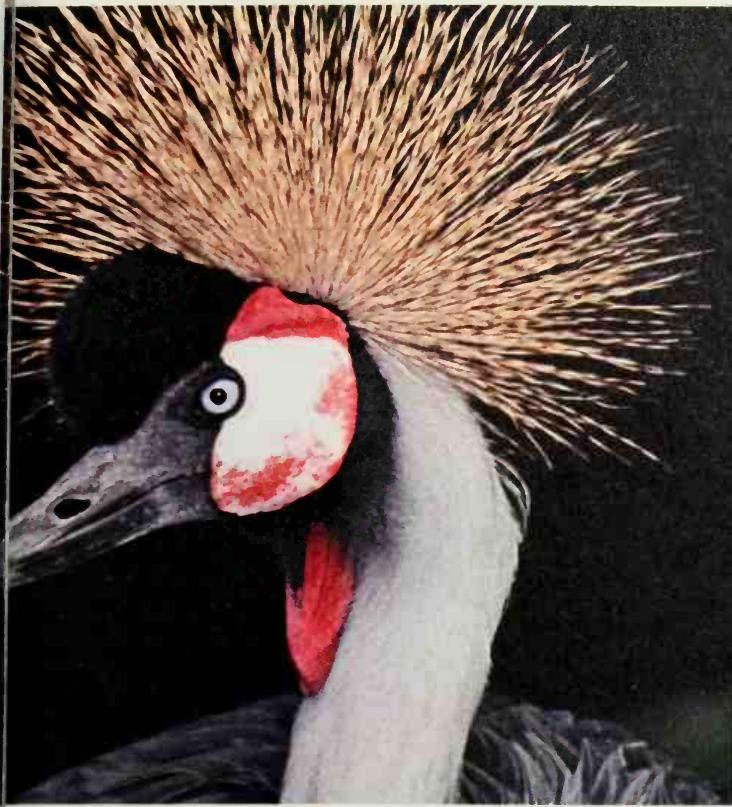
Most singing is done by male birds. But they do not sing only in order to attract or to court the female birds, as many people think. Male birds use song to warn away other birds from their area. There are notes, signals from one bird to another of the same kind. Song is also used as a means of alarm. Practically all species of birds recognize the alarm call. This call tells them almost immediately that something or someone dangerous or unwanted has come into their area. For example, if a snake slithers too close to a nest, the bird that sees the snake at once sounds the alarm call. Within a very short while birds of many kinds will appear in

the area and try to help get rid of the intruder snake. The African weaverbirds gather together and attack the snake that has come to steal eggs from their nests. They fiercely peck away at the snake and many times are able to kill it.

Bird singing is obviously a means of communication, a language. It differs from human language in that it is not learned. A bird is born with the ability to sing and to understand the language of song. Has anyone been able to decipher bird talk? I really don't think so, although some scientists say that today we are coming close to understanding it completely.

Well, my helicopter is ready to take off again. We're coming to the last stopover on our trip. As we fly quickly over most of the world, I'll try to give you some

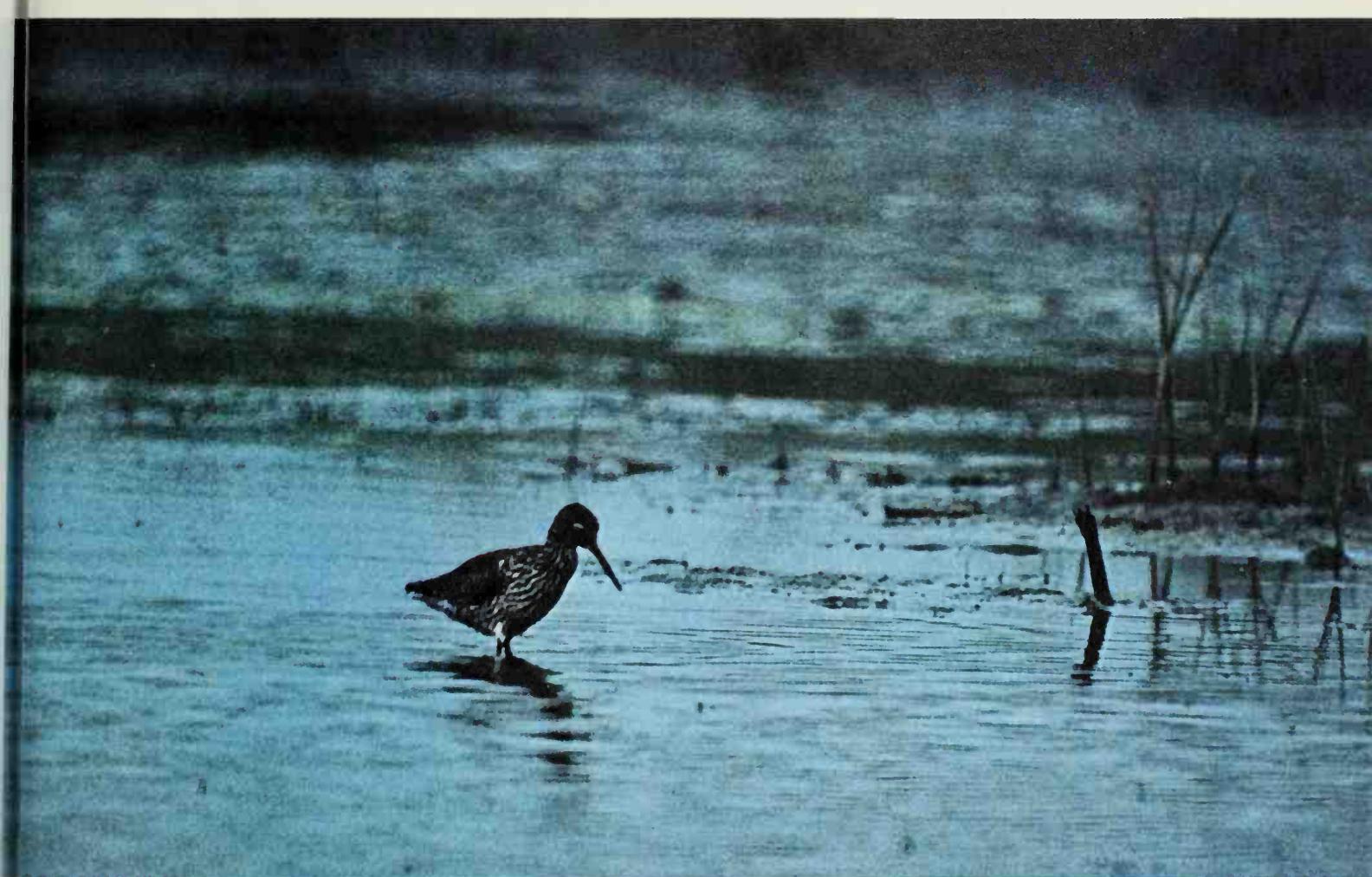




Above: The avocet, a long-legged wading bird with a slender upturned bill.

Left: The crowned crane has an unusual tuft of black and yellow feathers on its head.

Below: The redshank, so called because of the reddish color of its legs, searches for food.





Below: The Lady Amherst pheasant is found in the desolate mountain regions of Tibet and China. The male of the species is considered to be one of the most colorful birds in the world.

Right: Cormorants nest on the shores of Lake Malawi, in Africa. They catch fish by diving from the water's surface and chasing their prey underwater.



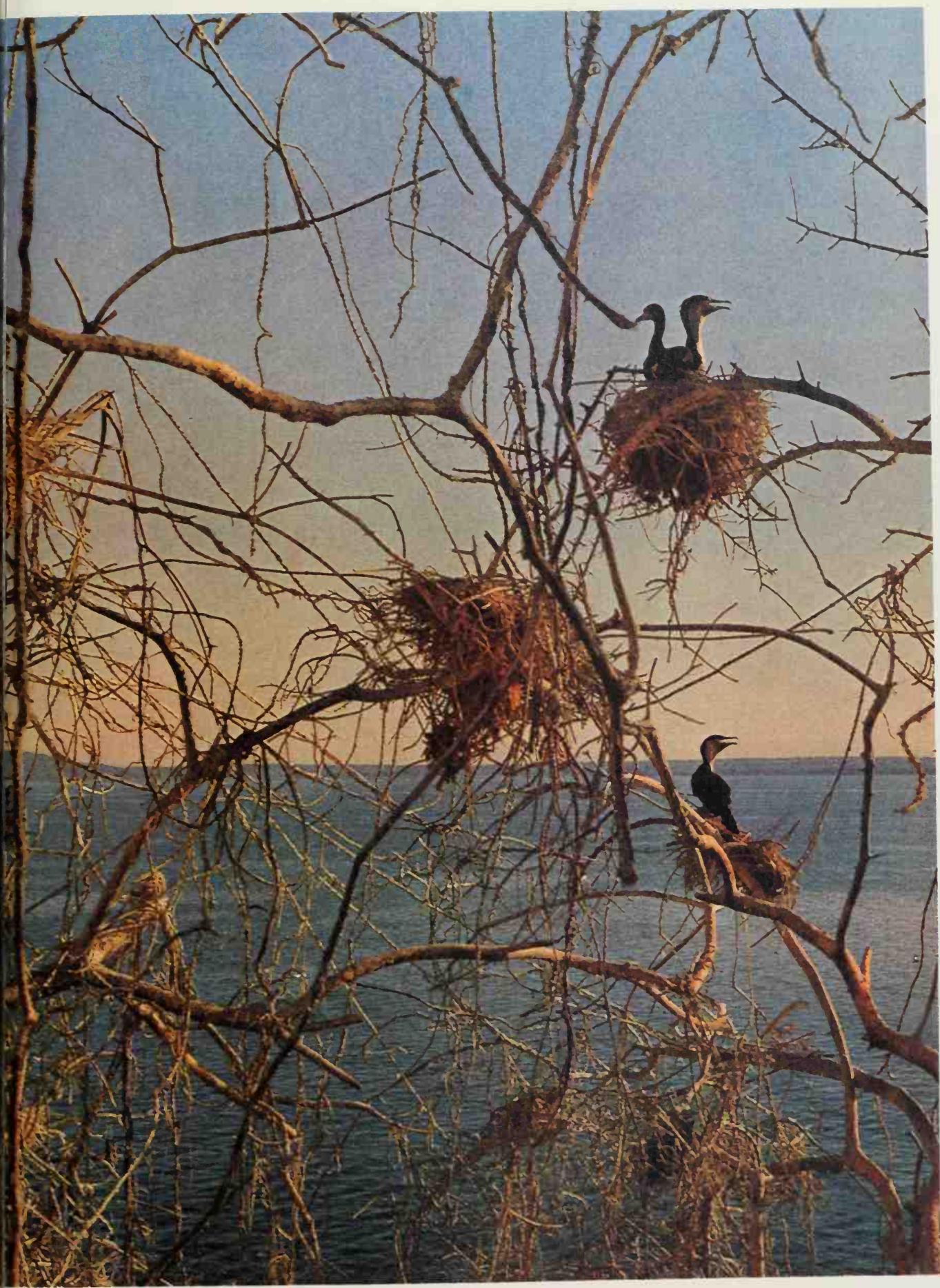
idea of the great variety of birds and tell you a little about the order and species to which they belong.

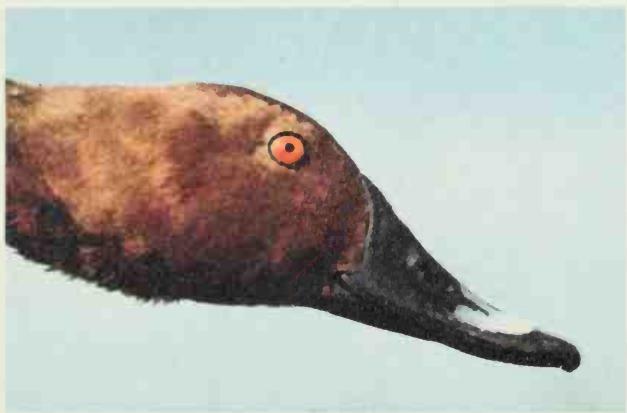
Of course my descriptions will have to be general. But I hope that when we are done you will know a little more about our friends the birds. So away!

BIRDS THAT RUN; BIRDS THAT SWIM

Let us start with the ostrich. Why? Because Grandma Duck has learned that the ostrich is the largest living bird. A full-grown bird stands about 8 feet high and weighs about 300 pounds. It is a flightless bird, but with its long legs the ostrich can really "fly" along the ground. It can reach speeds up to 40 miles an hour and is sometimes called the racing bird. Today the ostrich can be found only on the sandy wastes of Africa.

The second largest living bird is the





Above: The most distinctive feature of the canvas-back duck is its long, broad-based bill. It blends smoothly into the low, sloping forehead.

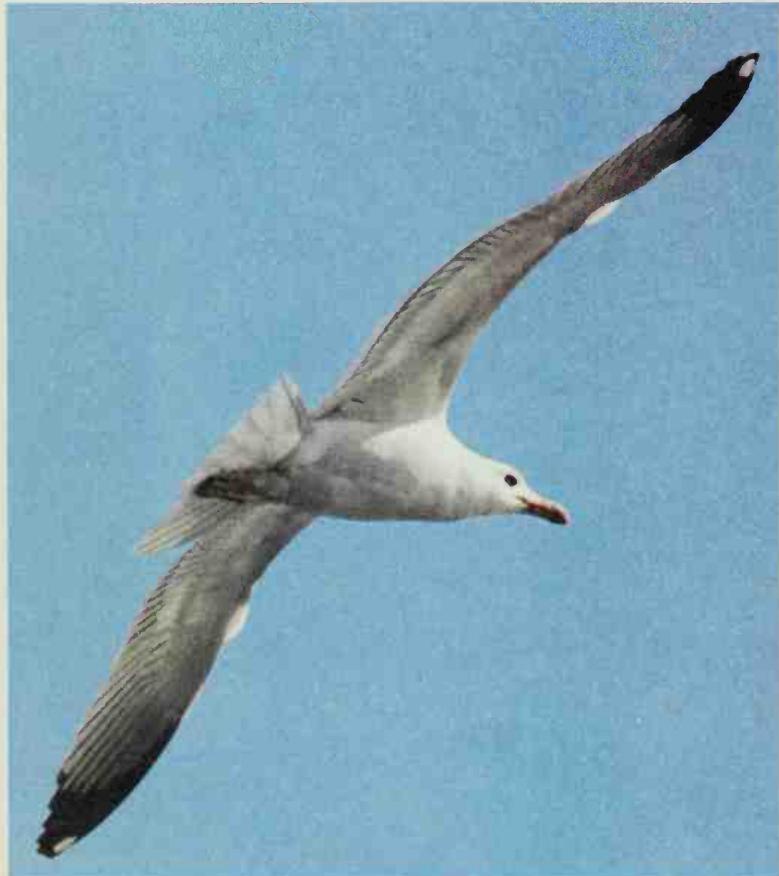
Below, left: The long, tapered wings of the wandering albatross are ideal for gliding flight. With proper winds, the bird can circle the world in 80 days!

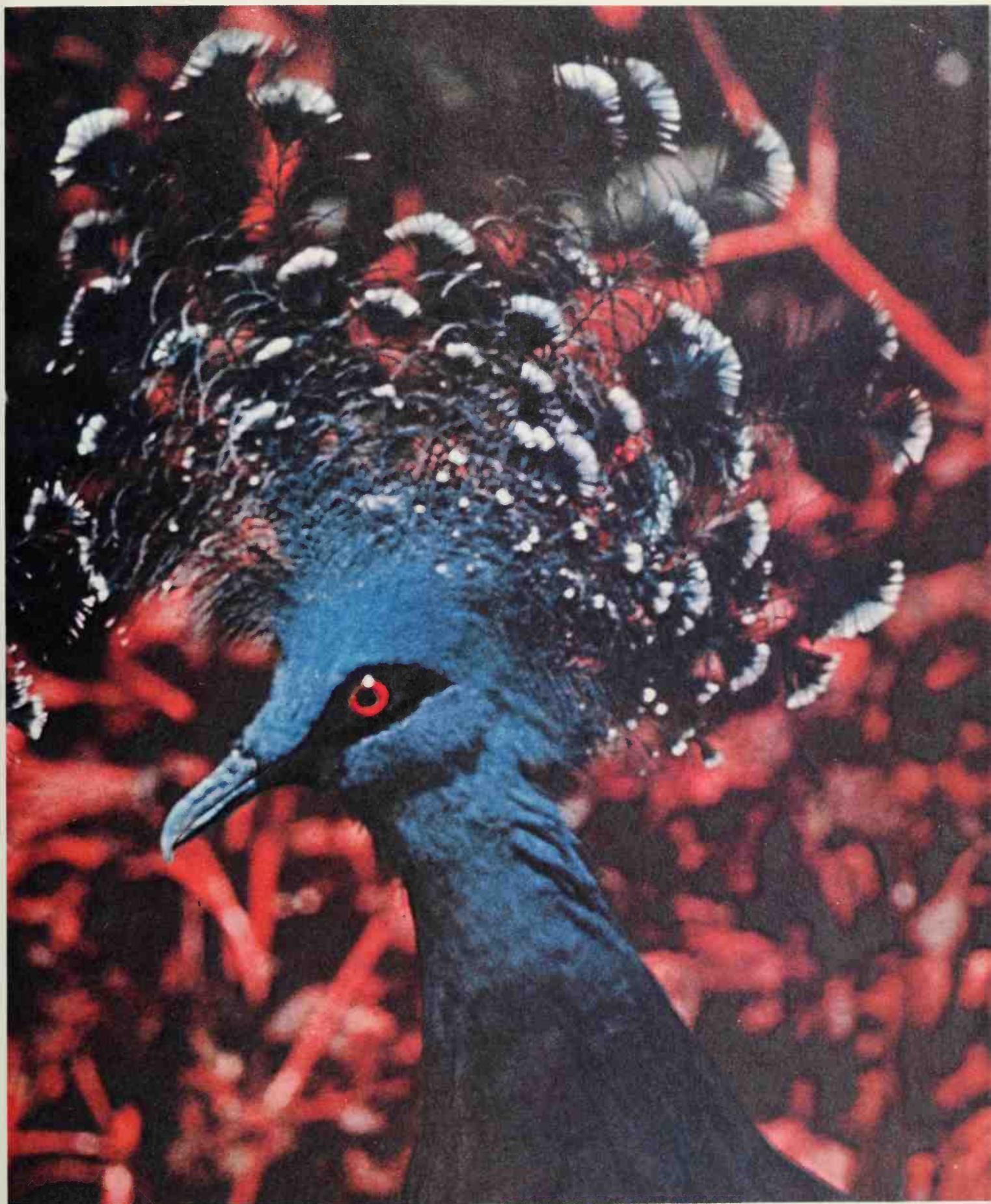
Below, right: The white pelican's gular pouch, just beneath its beak, is used as a net for catching fish. Pelicans keep the food in their pouch only long enough for the water to drain out. Then they swallow their prey.

Opposite page: The beautifully adorned common crown pigeon is the largest of all pigeons. It is found in New Guinea.

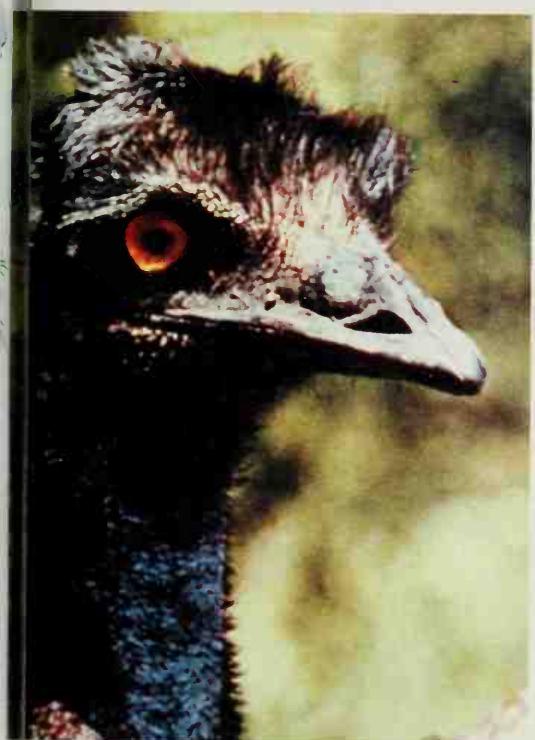
emu. It is about 6 feet tall and inhabits the plains and open forests of Australia. Like the cassowary, which is found mostly in New Guinea, the emu cannot fly. The rhea, which roams the pampas of South America, is the last of the large, flightless birds we'll talk about today. This big bird can run over the ground at tremendous speed. Some experts believe that it can run as fast as the ostrich. During the breeding season the male of the emu has a deep, booming voice.

The kiwi is a small, flightless bird of New Zealand. Its wings are so small that they can hardly be seen on the outside of the body. The kiwi has a long, narrow beak; its body is covered with feathers that look more like fur. An interesting and odd bird that cannot fly well is the grebe. This water bird has short legs, a pointed bill, and a crested head during courtship. It is related to the loon family.









Above, left: Roseate spoonbills are a nearly extinct species of bird. The few that remain in the United States have taken refuge in bird sanctuaries in Florida. The adult roseate spoonbill has beautiful pink wings, and, like all spoonbills, an oddly shaped beak.

Left: The emu, a close relative of the ostrich, is the second largest living bird. (The ostrich is the largest.) The emu can be found only in the open grasslands of Australia.

Above: Most species of albatross breed in small colonies on offshore or oceanic islands. Many times their nest is nothing more than a hole in the ground. Some albatross make a home out of a mound of soil or mud and line it with grasses and feathers. Here they lay their eggs.



Above: The nearly 12-foot wingspan of the wandering albatross is the largest of all living birds. One of the few times an albatross rests on land is during the breeding season. At this time the male bird bows and dances and attracts the female with groaning cries.

Below: The gannet is a large marine bird. It has very strong wings and is able to dive deep underwater in

search of food. When the gannet has caught a fish, he swallows it underwater and returns to the surface for air before taking off on his next dive.

Opposite page: The brown-black, white-flecked baby gannets take 4 years to reach maturity. During this period the head, neck, and underparts gradually turn white.





Awkward in flight, grebes often escape danger by diving. Most grebes are found in the temperate zones.

Now we come to the wonderful penguins. Penguins. You must know that that is their pen names. Ha Ha. Grandma Duck must have her little joke. But let me give you two different theories on how the word "penguin" came about. Some say it comes from the Welsh lan-

guage and the words "pen gwyn," which mean "white head." Others say that the name comes from the words "pin wing," which means "clipped wing." But we all know that penguins do not have clipped wings. In fact they have two flippers, which help them to swim swiftly through water. Penguins spend most of their lives in water. They come on land only to mate and to have their young.

MORE FEATHERED BEAUTIES

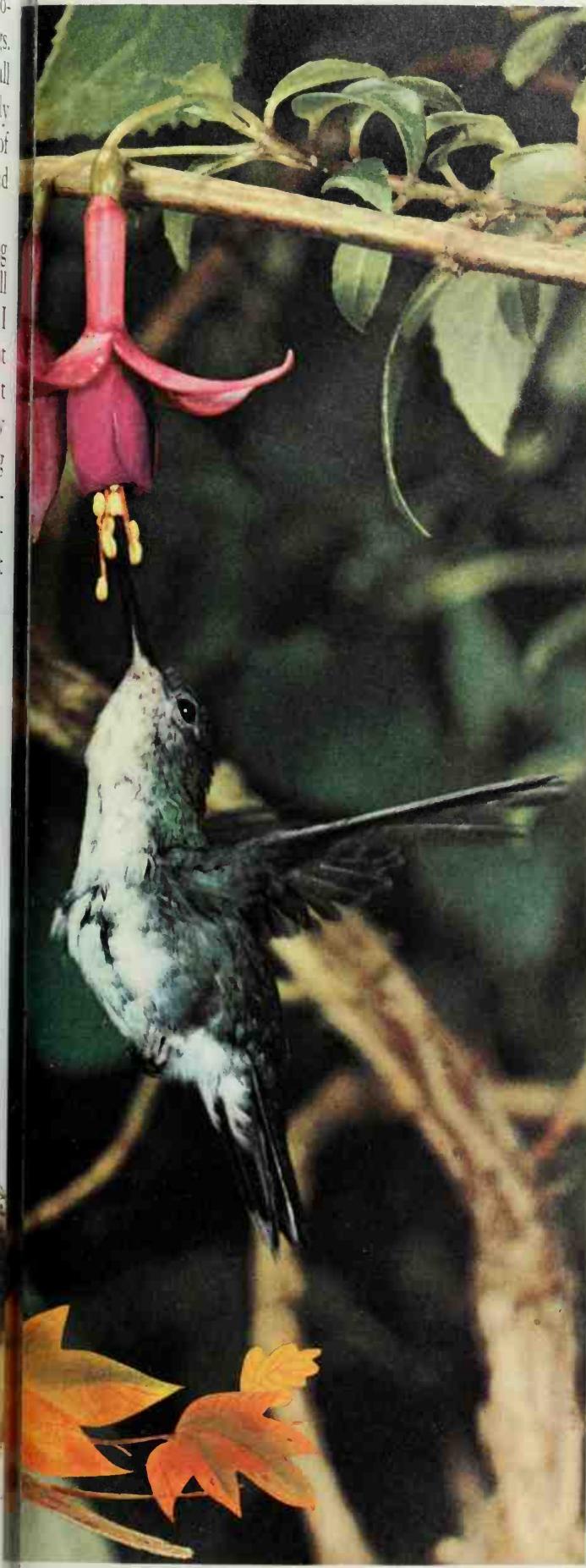
I would like now to have you meet one of the master gliders—the albatross. It rises into the wind and just glides over the water. This remarkable bird lives mostly around the cold southern seas. The wing of the albatross is long, narrow, and pointed. It is well suited for almost effortless flight in strong ocean winds. The albatross can go to sea for months at a time. Isn't that an accomplishment? It sleeps on the ocean surface and feeds on small sea creatures such as cuttlefish.

The next birds on our list are the Pelecaniformes, a family made up of pelicans

and other aquatic birds such as cormorants, gannets, frigate birds, and shags. The white pelican is the largest of all pelicans. His short legs support a body that may be 6 feet long. All members of the Pelecaniforme family have a hooked bill and four toes united by a web.

Herons, storks, and the ibises belong to the Ciconiiforme family. They are all long-legged birds. Have you noticed? I said "legs" because I would like to point out that these birds have two legs. Don't judge by appearance because when they are resting they hide one leg by tucking it under their bodies. These birds generally have long necks, very long and massive bills, long, broad wings, and short tails.





Above: The graceful Arctic tern in flight. These well-traveled birds breed in the Arctic region. Some of them spend the winter months in the Antarctic, thousands of miles from their home.

Left: Their short wings beat rapidly as the hummingbird sips nectar from a flower.

Below: A city of tunnels prepared by swallows.



Of all the wading birds the most curious are the flamingos. I really think they are elegant birds. Flamingos are found in tropical and subtropical regions throughout the world. They generally live near shallow lakes and lagoons. The flamingo, like the stork, can stand for hours on one leg. They are habitual waders, and their webbed feet help to support them on soft, muddy bottoms. When these birds are standing still in the low waters of a swamp, they remind Grandma Duck of a huge cluster of beautiful pink flowers!



BIRDS OF PREY AND OTHER BIRDS

Eat or be eaten is one of the laws of the animal world. This law also holds true in the kingdom of the birds. Birds that would rather eat than be eaten are called birds of prey. There are over 270 species of this type of bird and they are mostly falcons. Falcons are well equipped for their role in nature. They have beaks that are strong and curved, and they are ex-

tremely powerful flyers. The peregrine falcon is one of the fastest birds in all the world. Just try to picture it as it comes swooping down on its prey. Do you have any idea of how fast this bird can fly at that instant? The peregrine falcon can reach a speed of 180 miles an hour!

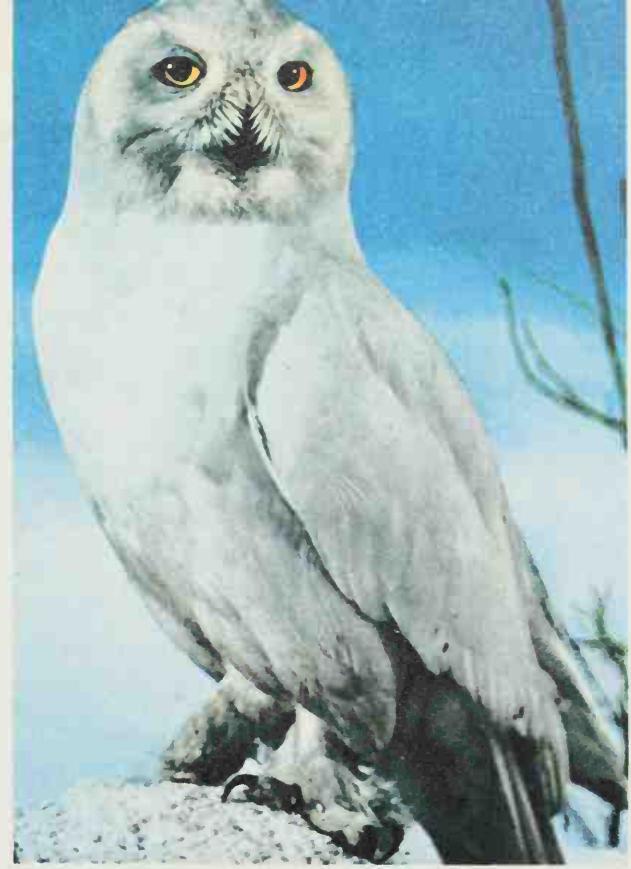
The feet of birds of prey, such as the eagles, hawks, and the owls, are worthy of our attention. The feet are very strong and have sharp, curved claws on all four toes. So these birds have feet that are

well-suited for grabbing hold of a small animal and carrying it into the sky. As I pointed out with the falcons, birds of prey have strong, hooked beaks. They use these beaks for tearing the prey apart if it is too bulky to be swallowed whole. Owls are night hunters and they have large eyes that see extremely well in the dark. What do owls hunt? Well, Grandma Duck has seen them hunting rats and mice. They're pretty good at it too. But there are a few kinds of owls that are especially adapted for fishing. The bottoms of their toes are curved, so that they are able to get a better grip on the fish they catch.

Hawks, falcons, and eagles have many different ways of getting their food. Marsh hawks fly over the open marshes in their search for food. They have long wings for gliding and slender feet for pouncing upon mice and other small prey. The fish hawk, or osprey, feeds almost entirely on fish. It dives into the water,

Opposite page, above: The large and threatening eyes of the owl are especially adapted for seeing in dim light. The owl's eyes are fixed forward, but he is able to turn his head completely to either side to see.

Opposite page, bottom: No other member of the owl family has the unusual oval-shaped face pattern of the barn owl. This unique creature nests in barns, belfries, and hollow trees. The owl is useful in destroying rats and other rodents that might damage orchards and garden crops.



Above: The adult male snowy owl makes his home in the Arctic. It stays close to marshes and shores. The male is almost completely white, while the female is specked with brown. When hungry the snowy owl will often attack other birds and even rabbits.

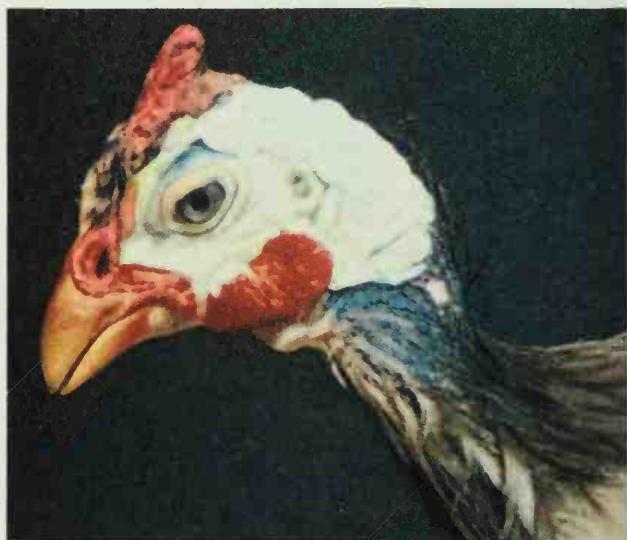


then grasps and holds the fish securely and flies triumphantly away. The hawks that hunt small birds in the woods have rather rounded wings and long feet and toes. Falcons fly in the open and have longer, pointed wings.

There's an interesting thing about the bald eagle. It really isn't bald. This bird was named at a time when "bald" meant "white" or "streaked with white." The adult bald eagle has white feathers on its head. Its tail is white too. However, its body and wings are dark brown. Its eyes, beak, and feet are yellow. The bald eagle has the largest beak of any hunting bird. This eagle is fond of fish and generally is found near a body of water. It feeds mainly on dead or dying fish. Sometimes the eagle steals its catch from the osprey, another large fishing bird. It doesn't live on fish alone. The bald eagle also catches and eats small animals. The huge bird swoops down, picks up the prey in its talons, and flies off. It has been estimated that an eagle, weighing 8 to 12 pounds, may be able to carry off an animal weighing as much as $7\frac{1}{2}$ pounds.

Now, Grandma Duck wants once and for all to destroy a myth. There has been a lot written and said about eagles carrying off babies. But that has never happened. There just is no evidence to support such a claim. So if anyone starts to tell you that eagles can carry off babies, you just send them to Grandma Duck. She'll take care of that nonsense.

Well, my friends, I have the feeling of having been here before. . . . I hardly noticed that I was back again and that the helicopter landed so softly on the front lawn. Hundreds of birds are singing around me, welcoming me back. I said back, but I don't mean to remain here for long! Just time to pick up some fresh clothes and then we'll be off again.





Opposite page, above: Two black grouse in their gala attire prepare for a duel.

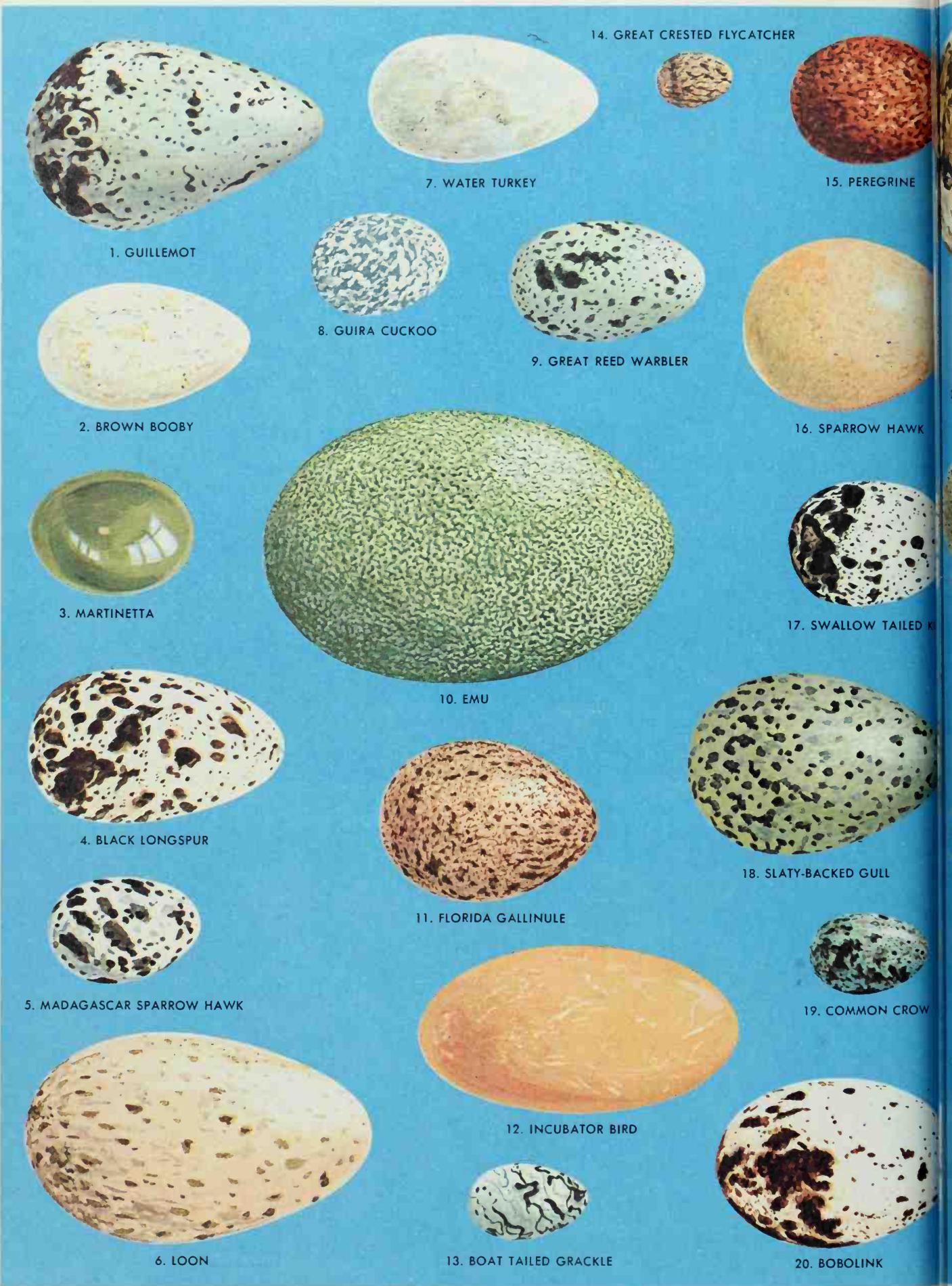
Opposite page, center: One of a species of the guinea hen. These birds were brought to Europe from Africa by early Greek and Roman travelers.

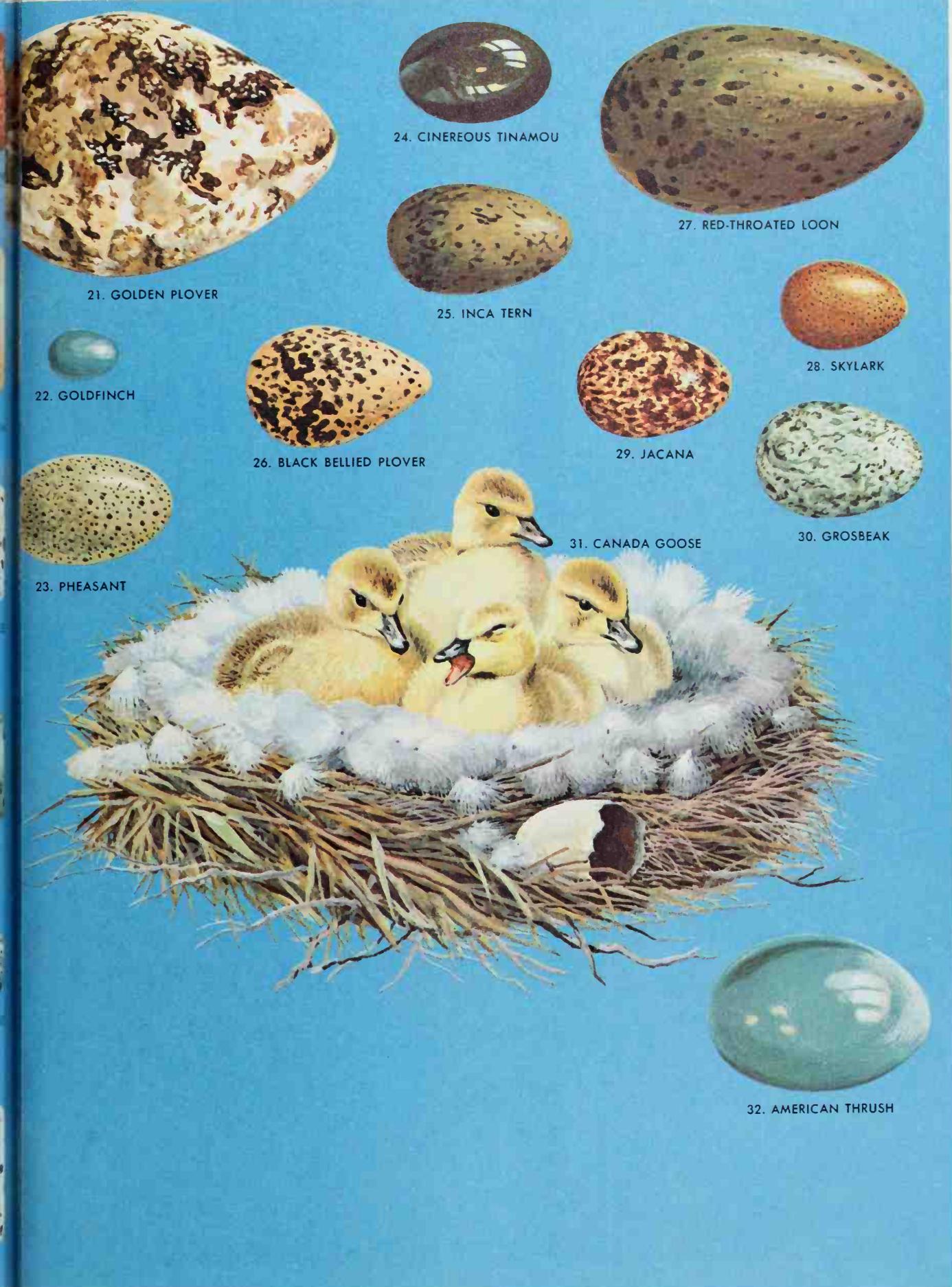
Opposite page, bottom: The male ruff has a unique breeding plumage. No two males have the same collar design.

Above: The ptarmigan has a different coat for each season. In the cold winter months, he protects himself with thick white feathers. Even his legs are heavily feathered.

Below: One of a species of the Penelope family. These birds live on treetops in the dense forests of South America, and they feed on fruit.









AMPHIBIANS AND REPTILES



And now, boys and girls, how about joining Grandma Duck on a visit to the fascinating world of amphibians and reptiles? But first I'd like to tell you something about these strange creatures.

Amphibians are animals that spend part of their lives in water and part on land. Their name comes from two Greek words —*amphi*, meaning "double," and *bios*, meaning "life." Frogs, salamanders, and toads are all amphibians.

The earth's first vertebrates (animals with backbones) were fish. More than 300,000,000 years ago, fish began to undergo certain changes. Scientists think that over a period of millions of years a strange-looking animal with footlike fins and a kind of lung managed to flop its way from water to land. As millions of years more passed, a new kind of animal developed. This one had proper legs for walking on land and proper lungs for breathing out of water. This was the first vertebrate to walk on land. So amphibians are really the link between vertebrates that live in water and those that live on land.

Reptiles gradually developed from amphibians. Today there are about 6,000 kinds of reptiles including crocodiles, tur-

tles, lizards, and snakes. A reptile's body is covered by dry, scaly skin. Most reptiles have four legs with five clawed toes on each. All reptiles breathe air through their lungs. Scientists say that the first birds developed from certain reptiles.

ANIMALS WITHOUT LEGS

Snakes are reptiles that have no legs. They probably developed from some types of burrowing lizards whose underground habits made legs unnecessary.

Scientists believe that there are over 3,000 kinds of snakes in the world today. Most of these live in the earth's warmer regions, but a few variations are found in cold, mountainous areas. Sea snakes inhabit all the tropical seas except the Atlantic Ocean and the Caribbean. Many varieties, especially those that live in tropical countries, live only in trees.

Snakes range in size from tiny blind snakes to serpents 30 feet long. They all have many things in common. Their skins are covered with scales that keep their bodies from losing too much moisture, and their glassy stare is caused by the fact that they do not have movable eyelids. Most snakes have only one lung.

All snakes are carnivorous—that is, they eat animals. They catch their prey with needle-like teeth and swallow it whole.

A snake's jaws are very loosely attached to the other bones of the skull, and the upper and lower jaws are separate. Each jaw has a row of teeth, and many snakes have two more rows of teeth in the roof of their mouths. This makes it possible for snakes to swallow very large animals.

All snakes have a strong sense of taste and smell. But probably the most amazing thing of all is the snake's forked tongue. With it snakes can pick up objects and thrust them into two highly sensitive

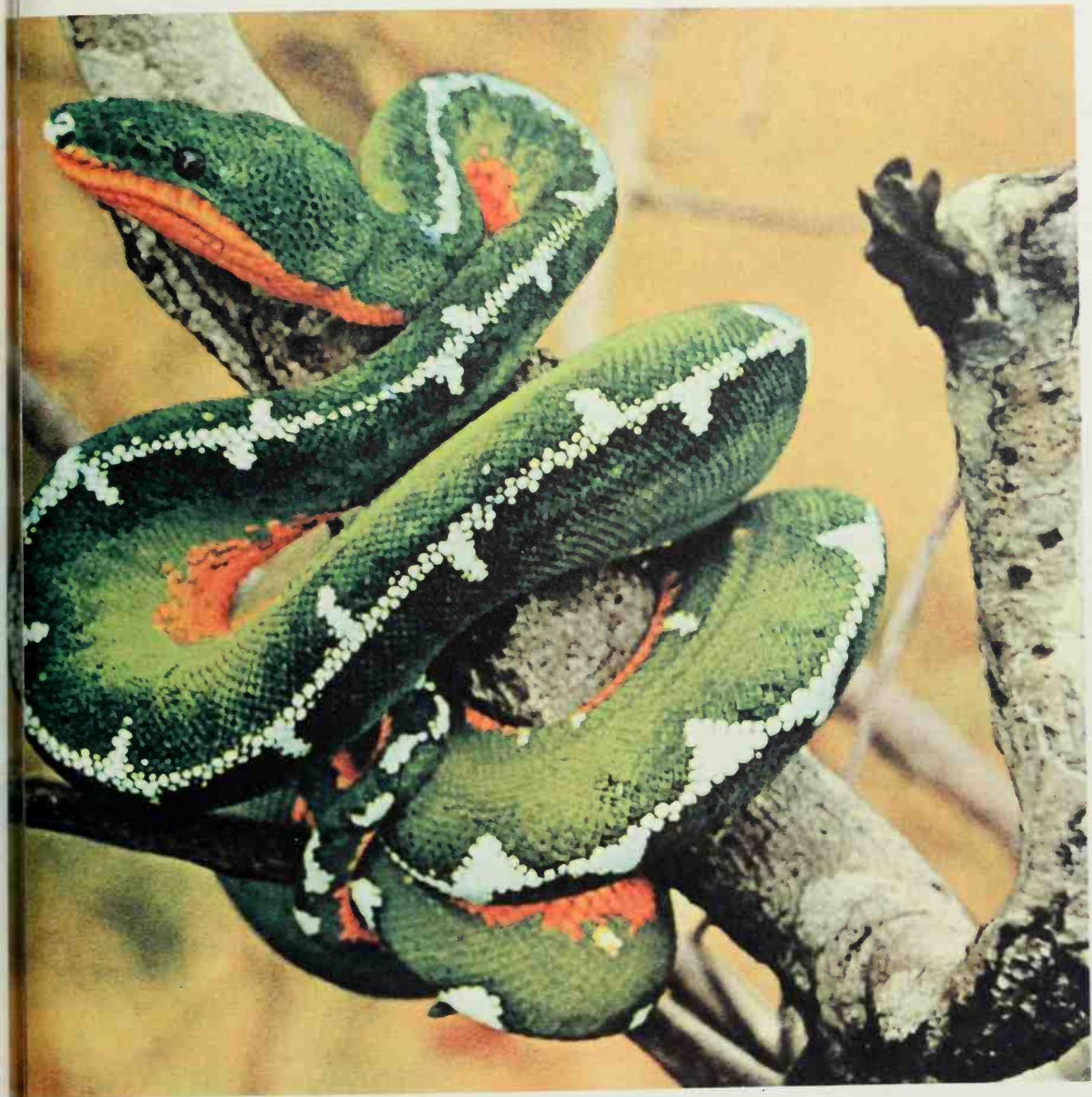


Above: A common European viper, or adder. It is the most widely found poisonous snake in Europe. Because its natural enemies—badgers, birds of prey, and hedgehogs—have been declining in number, the viper has increased in wooded areas.

Left: The rattlesnake, a poisonous snake of the Americas. It is the only snake to have a rattle—hornlike rings at the end of its tail—which it shakes when it is alarmed. It usually lives in the desert.

Opposite page: The vivid emerald tree boa of South America.



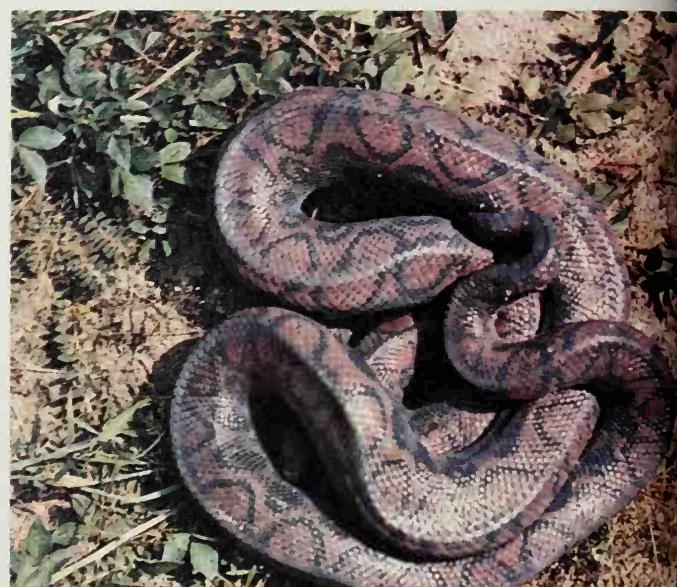


openings in the roof of the mouth.

Most snakes are hatched from eggs. But some, like copperheads, rattlesnakes, boas, and garter snakes, bear living young.

Many snakes spend the winter in dark dens. In the spring they come out and warm their bodies. Spring is usually the mating season.

About 2 months after mating, the female searches for a warm, moist place to lay her eggs. Most lay about 15 eggs, but the python may lay more than 100. Snakes that bear living young carry them within their bodies for 4 or 5 months. After the young are born or hatched the mother snake pays no attention to them. The young snake sheds its skin for the



Top: An Arizona king snake. It was given this name because it boldly attacks rattlesnakes, to whose venom it is immune. King snakes are nonpoisonous, and they are most commonly found in the United States.

Above: A rainbow boa. Its skin gleams with rainbow-like effects, and it sometimes exceeds 6 feet in length. This boa lives in the Amazon jungles of South America.

Opposite page: The common lizard.



first time, a process it will repeat several times throughout its life.

So far I haven't said a word about snakes whose venom, or saliva, is poisonous. But don't be alarmed! Most snakes are harmless, and it's unlikely that you'll see a venomous cobra or viper in your backyard!

THE LIZARD FAMILY

Lizards are fascinating animals. There are about 3,000 different varieties of lizards, and they range in size from the 10 foot Komodo monitor of Indonesia to the tiny gecko.

If you've ever seen a lizard, you'll agree that they're pretty strange-looking animals. Most of them have short bodies covered with scaly skins that they shed

several times a year. They crawl along the ground on four short legs with their long tails trailing behind. Some look like fierce dragons, others resemble ugly little worms.

Lizards are found in every part of the world with the exception of the polar regions. Those that live in the temperate regions must hibernate during the winter months. This means that when the weather gets really cold they have to find a warm, protected place to live.

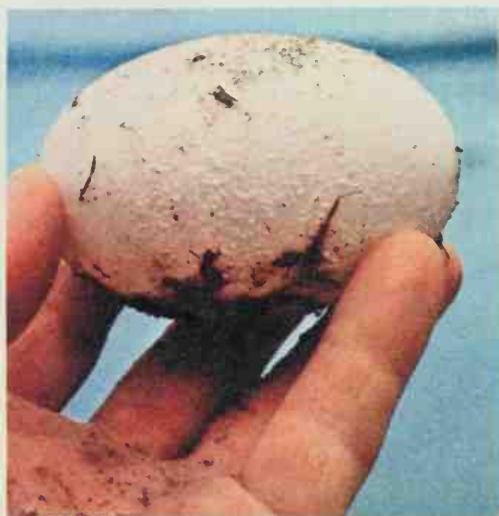
Most lizards are born from eggs, although many species bear living young. Sometimes the female carries the eggs in her body. Frequently the eggs are buried in soil or decaying logs. The female often guards the eggs against other animals that might eat them.

Most lizards live on insects they pluck



Above: An unusual photograph of a crocodile walking. It generally spends most of its time in the water or lying on the shore. The crocodile is a massive reptile, but it has strong legs and can run quickly for short distances. It also has powerful jaws, and is capable of administering a deadly blow with its tail.

Below: A crocodile egg. The egg is small. At birth the crocodile resembles an ordinary lizard.

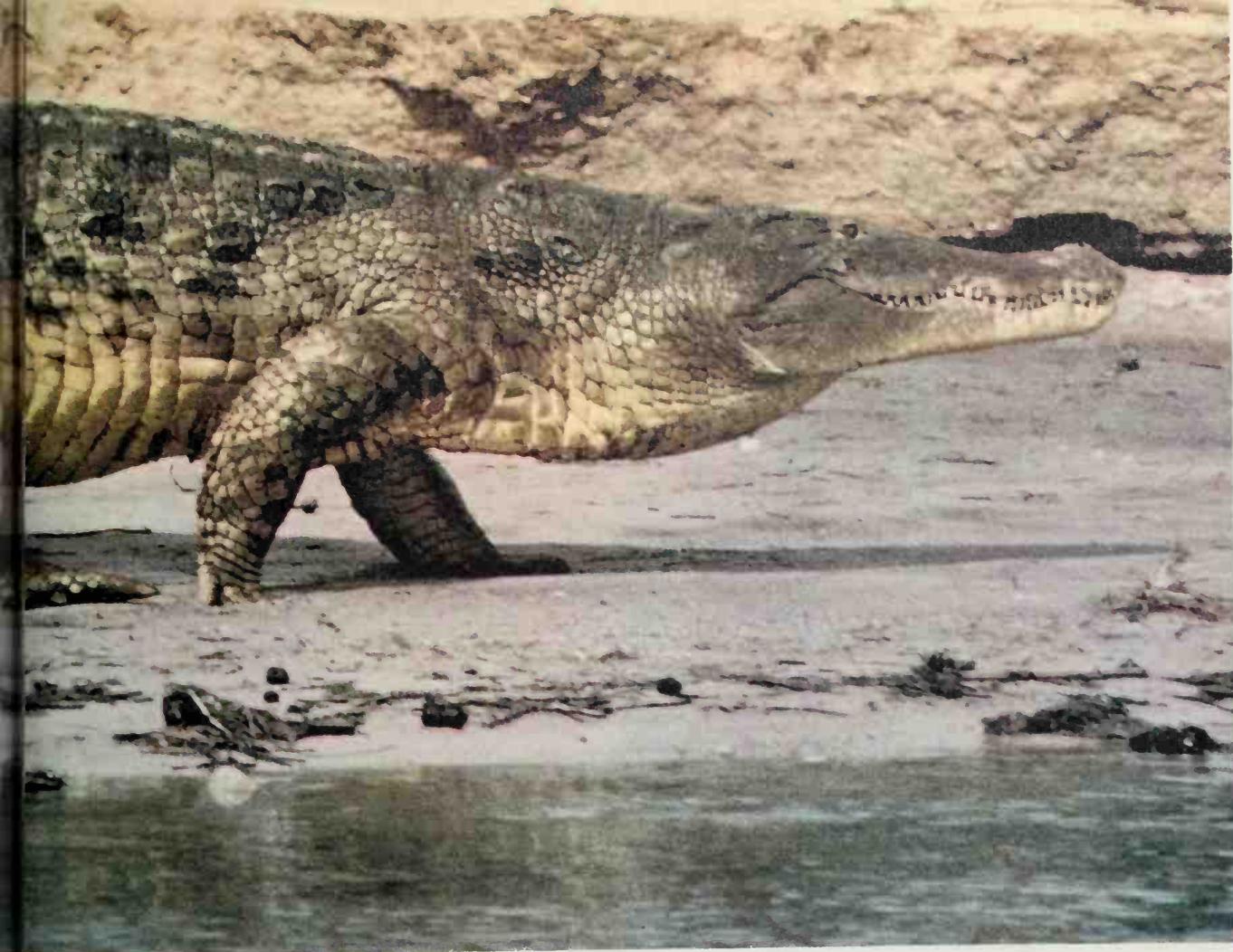


out of the air with their tongues. Lizards have a highly developed sense of taste and smell.

A MASTER OF DISGUISE

Have you ever had a lizard as a pet? If so, your pet was probably an anole, which pet shops often call chameleons.

Anoles and many other kinds of lizards, including the true chameleon of Africa and Asia, can change color. If they light on a leaf, their bodies turn green. If they crawl along the sandy banks of a river, their bodies turn a yellowish, sandy color. In this way these lizards can camouflage, or disguise, themselves as they wait for the perfect moment to attack their prey. Their changing color also protects them from their enemies.



If you own an anole, try this experiment with it. Place it on the leaf of a tree. If you watch carefully you will see its skin change slowly to the green of the leaf. Then place the lizard in an empty box. Gradually your pet will become as pale as the color of the box. Many people don't understand how these lizards change color. (It's a secret I'd really like to keep from Uncle Scrooge, but I'll let you in on it.) The truth is that the color of these changeable lizards is not controlled by the color of the leaf or the box. Instead it is affected by the lizard's feelings as it moves from place to place and also by differences of light and temperature. The lizard's nervous system is very sensitive and the lizard reacts by changing color.

A chameleon's eyes are covered with thick lids. There is a hole in the lid that

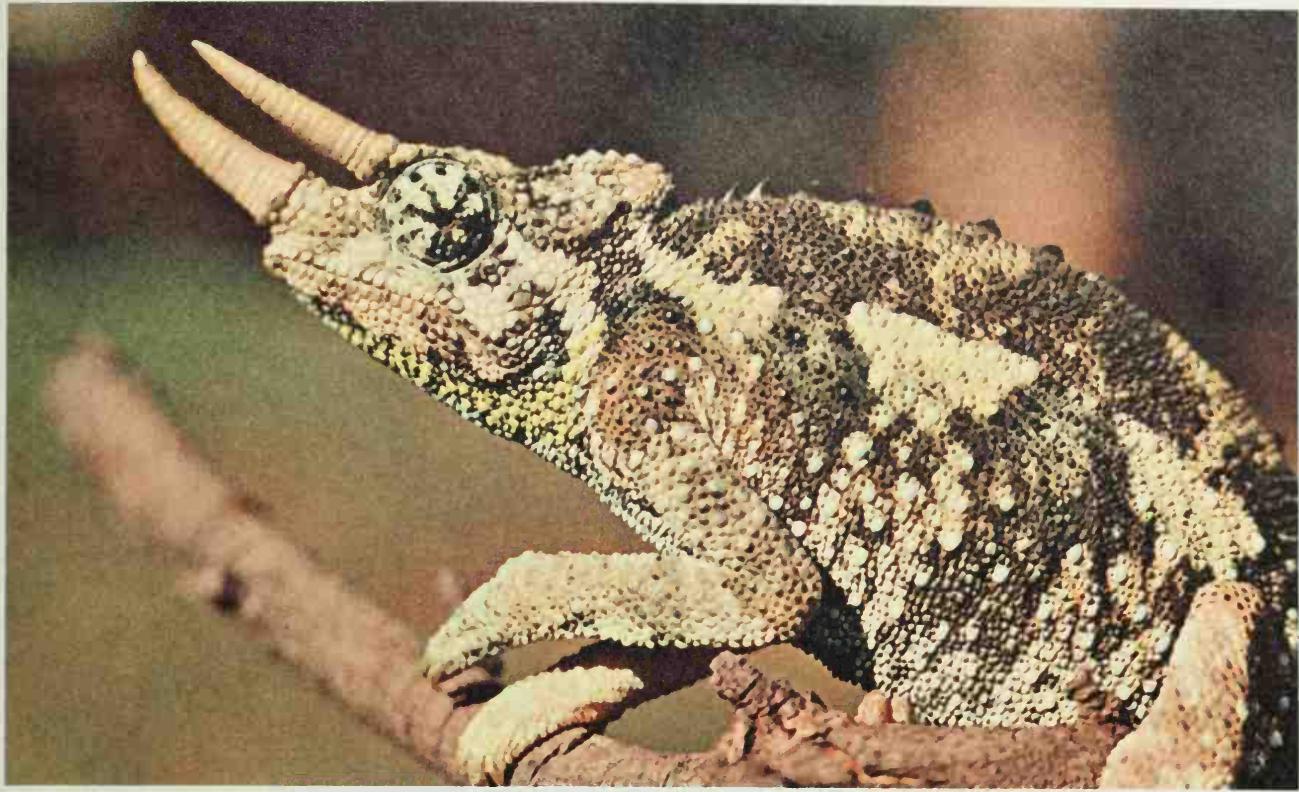
makes it possible for the animal to see. The eyes move in all directions independently of the head.

Chameleons' bodies move slowly, but their tongues dart in and out with great speed. On the tip of the tongue is a disk covered with a sticky liquid. The flick of the lizard's tongue is so fast it can be seen only by slow motion cameras!

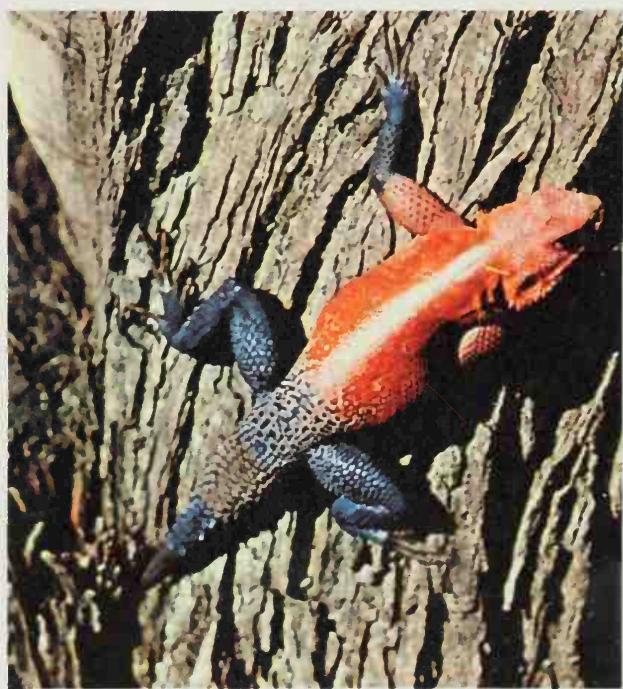
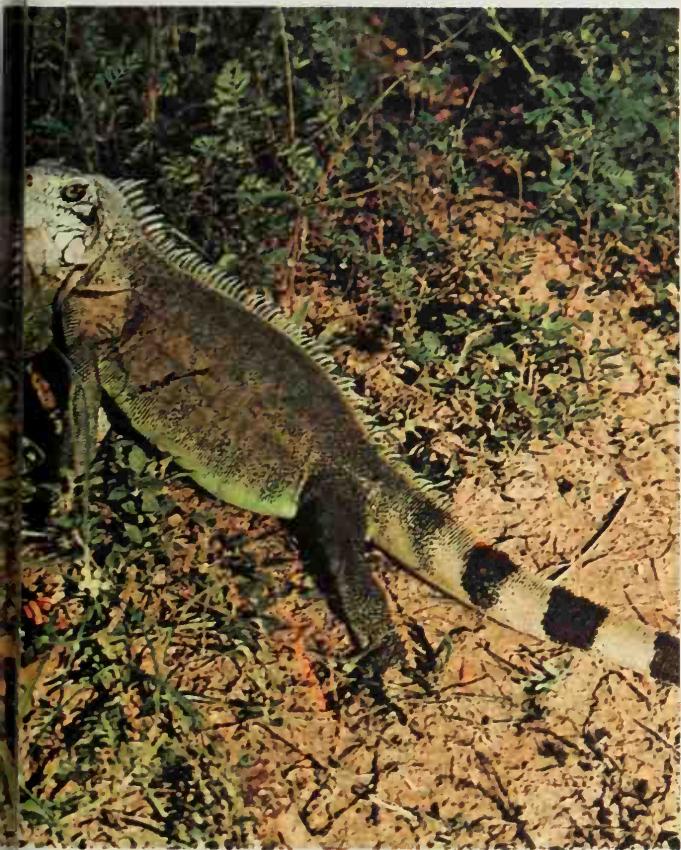
FRIEND OR ENEMY?

About 25 kinds of reptiles belong to a group called crocodilians. Crocodilians include crocodiles, alligators, caymans, and gavials. All the members of the crocodilian group look very much alike—and they're not pretty, at least by my standards. In fact they're so ugly that Uncle Scrooge is afraid of them.





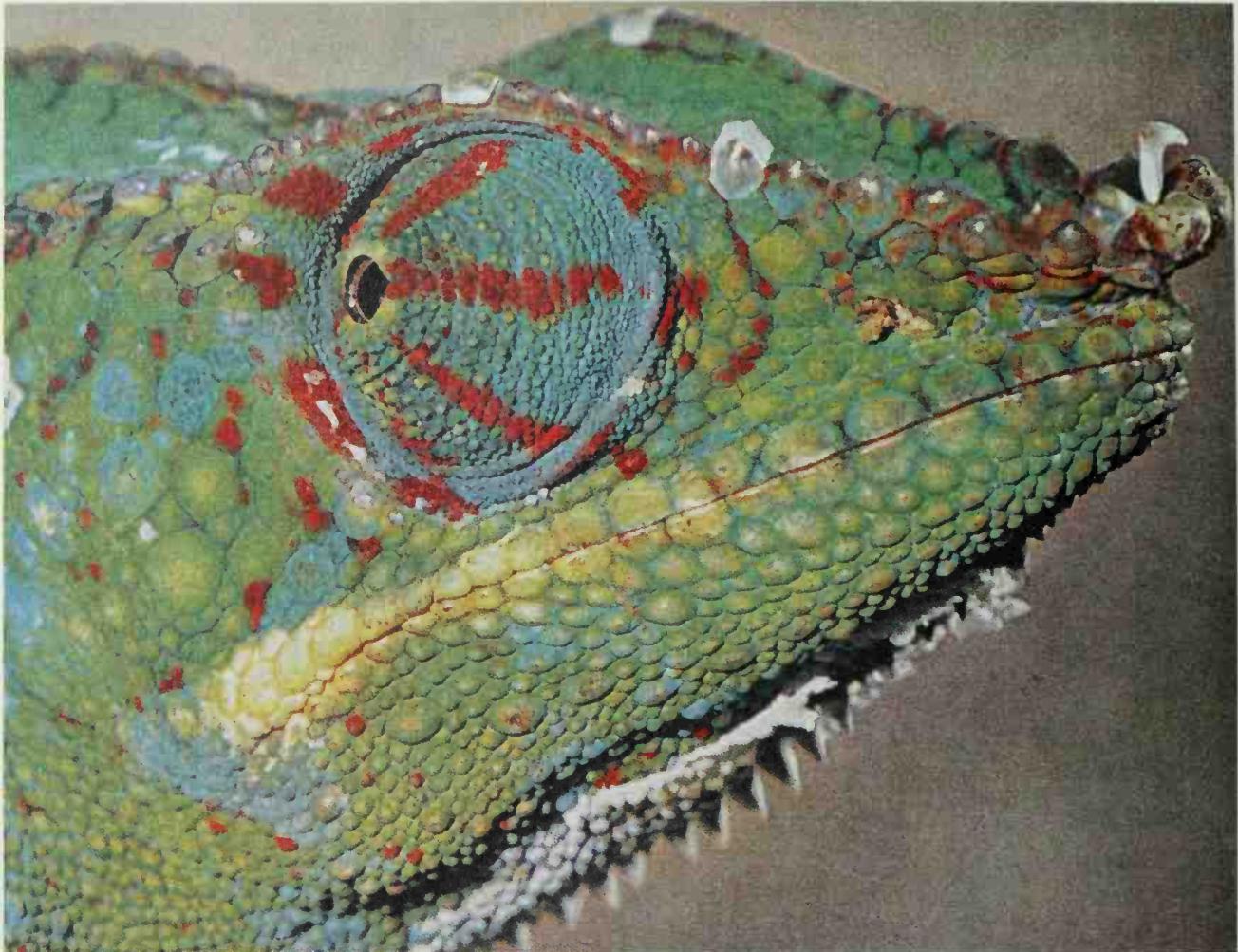
Opposite page: A horned lizard. This harmless animal rarely bites. Under stress, it squirts blood from its eyes. The lizard likes to burrow in the sand, and it is most often found in the plains of the United States.



Above, top: A two-horned chameleon of Kenya, Africa.

Left: The common iguana. It can reach a length of 6 feet, over half of which is tail. Some iguanas can stand partially erect and run on two feet. A popular pet, it lives mainly in the hot regions of the Americas.

Above, right: Normally brown, this lizard becomes brightly colored during its mating season.



Since I'm a lot braver than Uncle Scrooge, I've examined crocodilians closely enough to tell you a little bit about how you can tell them apart.

The best way to tell one crocodilian from another is to look at their faces. The snout of the true crocodile is long and pointed, and its head is almost triangular in shape. Alligators and caymans have very broad snouts, and the gavial's snout is extremely long and thin.

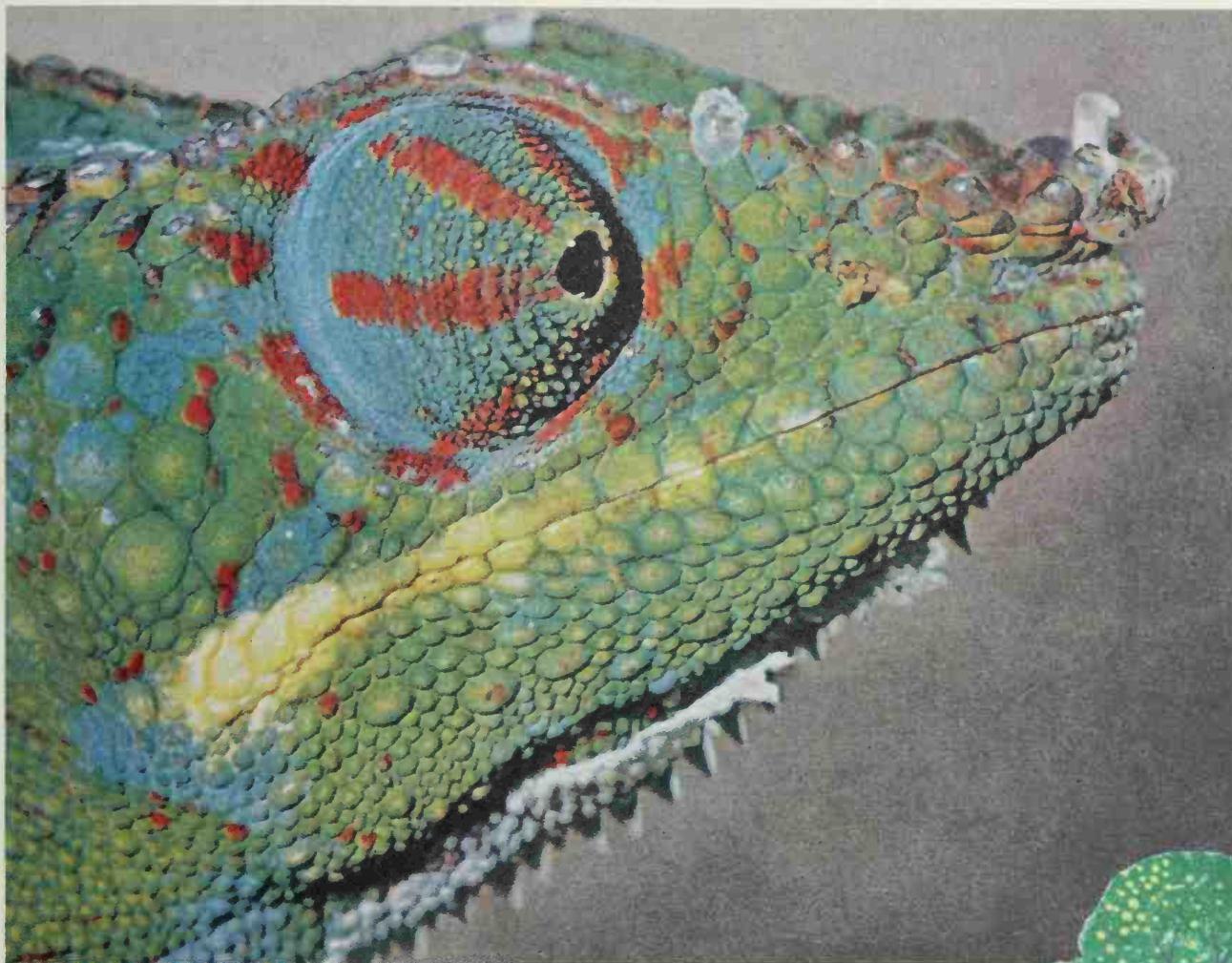
All crocodilians have long tails. Their skin is covered with hard, leathery scales. Most of them live in the tropics, but some inhabit the warm, moist regions of the temperate zones. They spend their lives near freshwater lakes, rivers, or swamps, or in the salt waters of the coastal regions.

Crocodilians eat fish, birds, and other animals. Sometimes, especially if they're wounded, they attack people—so beware!

SHELL-COVERED MYSTERIES

The reptile Uncle Scrooge likes best is the turtle. Turtle meat makes delicious soup, and Uncle Scrooge's favorite pastime is eating. Donald Duck, on the other hand, calls these shell-covered reptiles tortoises and doesn't like them at all.

What do you call them? You can say either "turtle" or "tortoise," without making a mistake. In most English-speaking countries "tortoise" is the name given



*Opposite page and above:
The eyes of the chameleon
are most unusual. They are
cone-shaped, and the
chameleon looks through
the small openings at the
tip of the cone. Not only
does the entire eye rotate,
but each eye can move in-
dependently in different
directions. When it sees
its prey, usually an insect,
the chameleon focuses both
eyes forward and can figure
out the exact position of
the prey. It then flicks out
its tongue, which is often
longer than its body. The
tip of the tongue is covered
with a gluey substance,
which causes the victim to
stick to it. When not in use,
the tongue folds like an ac-
cordion inside the mouth.*





Above: A tree frog. It lives on trees close to the water, and it changes its color to blend with the surroundings. The bright green frog on the right, for example, has just come out of hiding among the leaves. After sitting on a tree trunk for a few minutes, the frog turned the gray color seen on the left in order to blend with the grayish trunk.

Opposite page: A Tokay gecko lizard. Its name comes from the typical "geck-geck" sound it makes with its fleshy tongue. This small lizard is an excellent climber. It can move straight up and down, over smooth surfaces, or upside down across a ceiling. The undersides of its toes have rows of extremely tiny hairs that are branched at the end. These rows enable the gecko to adhere to the surface on which it is walking. Geckos are found in warm climates.

to land turtles and freshwater turtles. But to make things a bit less confusing most scientists now use "turtle" for all kinds: land, freshwater, and ocean turtles.

Turtles are the oldest group of the reptile family. There are about 250 different kinds, ranging in size from tiny bog turtles less than 3 inches long to giant leatherbacks that grow to almost 9 feet and weigh about $\frac{3}{4}$ of a ton.

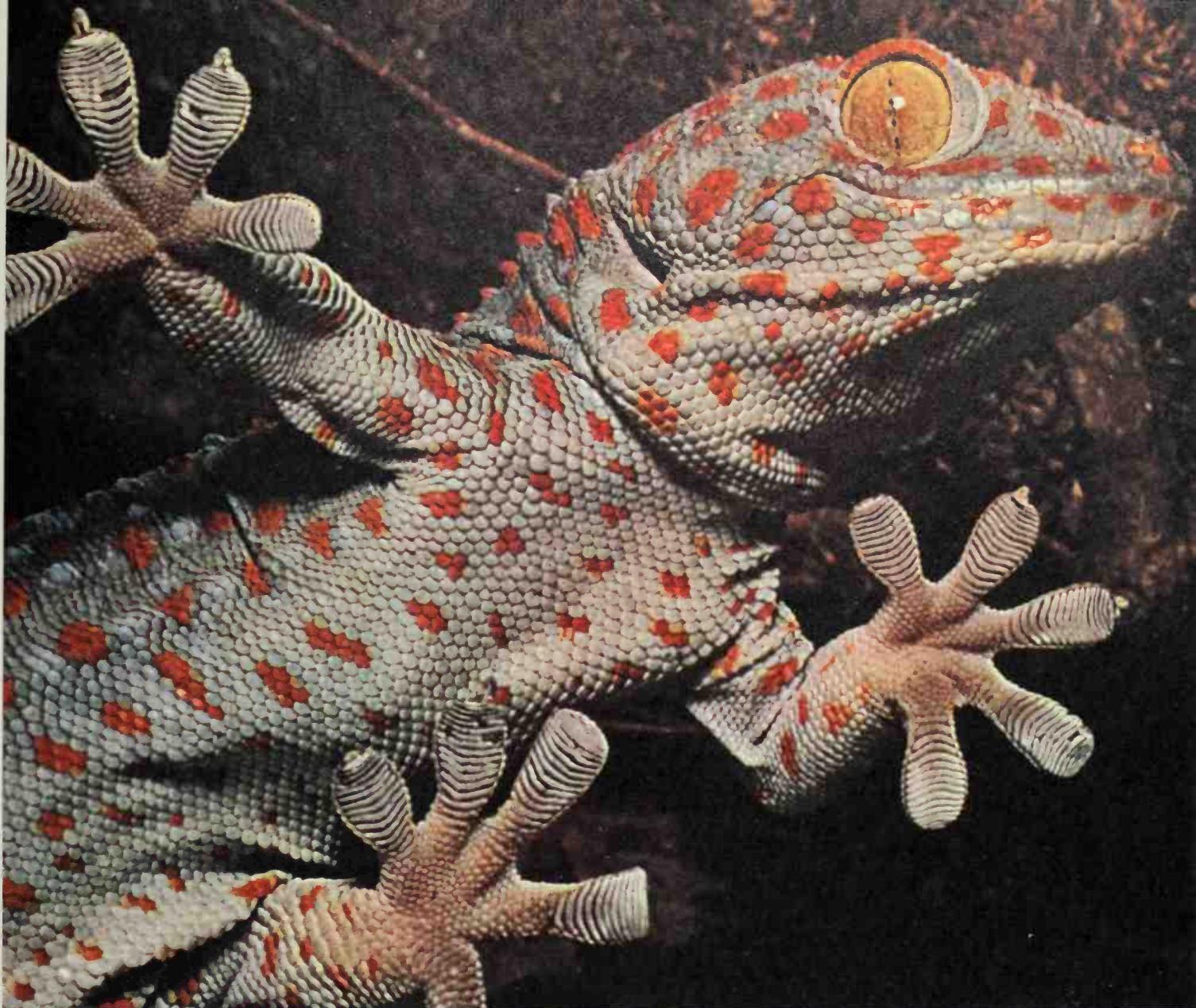
All turtles have a two-part shell. The upper part is called the carapace, the lower part is called the plastron. The two

parts are joined at the sides by bony ridges. The turtle's four chunky legs, fleshy tail, and head stick out through openings between the top and bottom parts. When a turtle is frightened it can pull its head, legs, and tail inside its shell. A turtle has no teeth. It seizes its prey with its beak and often swallows it whole.

Turtles are found in almost all parts of the world. Many spend a good deal of their lives in water. Those that live completely on land are the clumsiest and slowest of all the members of the turtle family.

No matter where they live, all turtles lay their eggs on land. Most of them lay from two to 25 eggs at a time, but large sea turtles may lay over 150. After the female packs sand around the eggs, she returns to the water or moves off into the underbrush and has no further interest in her young.

Turtles live longer than any other animal except man. Some are known to have lived 100 years. They have very good eyesight and excellent hearing. Most interesting of all, they seem to have a "sixth sense" that guides hatchlings to water and



leads adults across hundreds of miles of sea to distant nesting grounds.

TENORS AND BASSOS

The amphibians most North Americans know best are probably frogs and toads. But familiar as these animals are, many people have difficulty telling them apart. Let Grandma Duck give you a few tips that might clear up the confusion.

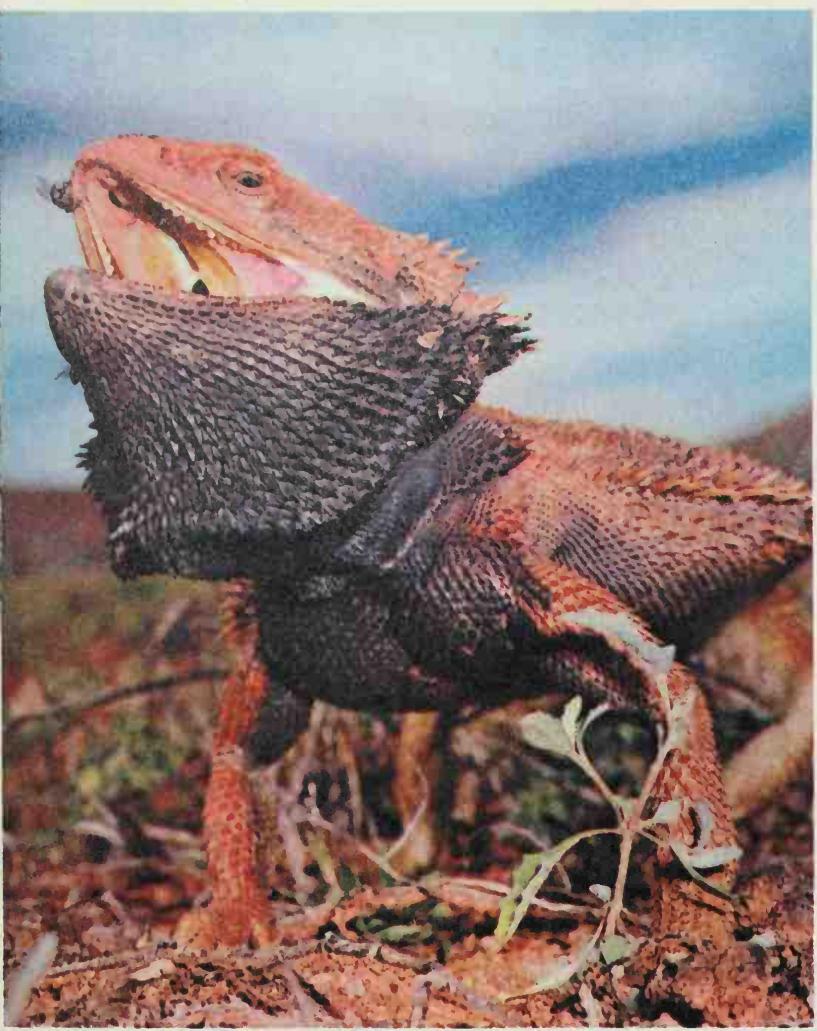
In general toads are squatter and heavier than frogs. Their skin is thick, dry, and warty-looking. The bodies of frogs are

longer and slimmer, and their skin is moist and smooth.

Both frogs and toads have long, strong legs. They are excellent leapers and jumpers. They like to live in warm, damp places. They are found all over the world except in the polar regions and on some islands. About 90 different species are found in the United States.

Most frogs and toads lay their eggs in fresh water, and many species lay between 1,000 and 2,000 eggs. The eggs of most species are protected by a mass of jelly-like material that surrounds them.

In a few weeks the eggs hatch, and small, soft-skinned animals called tadpoles



Above: An Australian bearded lizard. When in danger, it puffs up its thorny collar and changes color.



Above: An Australian moloch. This small lizard is about 8 inches long. Its colors and flattened body make it difficult to spot among the leaves.



swim out. At birth they have finned tails and furry gills. In time tadpoles change into animals that can live on land.

At first the gills of a tadpole are outside the body. Soon, however, they become covered by a fold of skin. Then the lungs and legs develop, and the tail is absorbed into the body. This change the tadpole undergoes from a water animal to a land animal is called metamorphosis.

Both frogs and toads live mainly on insects. Frogs flick out their rough, sticky tongues to catch swiftly-moving insects. Then they flip the insects into their mouths. Frogs and toads are helpful to man because they eat harmful insects. A small toad may fill its stomach with insects four times a day.

Frogs and toads are the songsters of the reptile family. The males attract their mates by calling. Oddly enough the sounds do not come from the animals' open mouths. They are made as air passes from lungs to mouth across the vocal chords. The piping of a tiny frog can often be heard as far away as a mile or more.

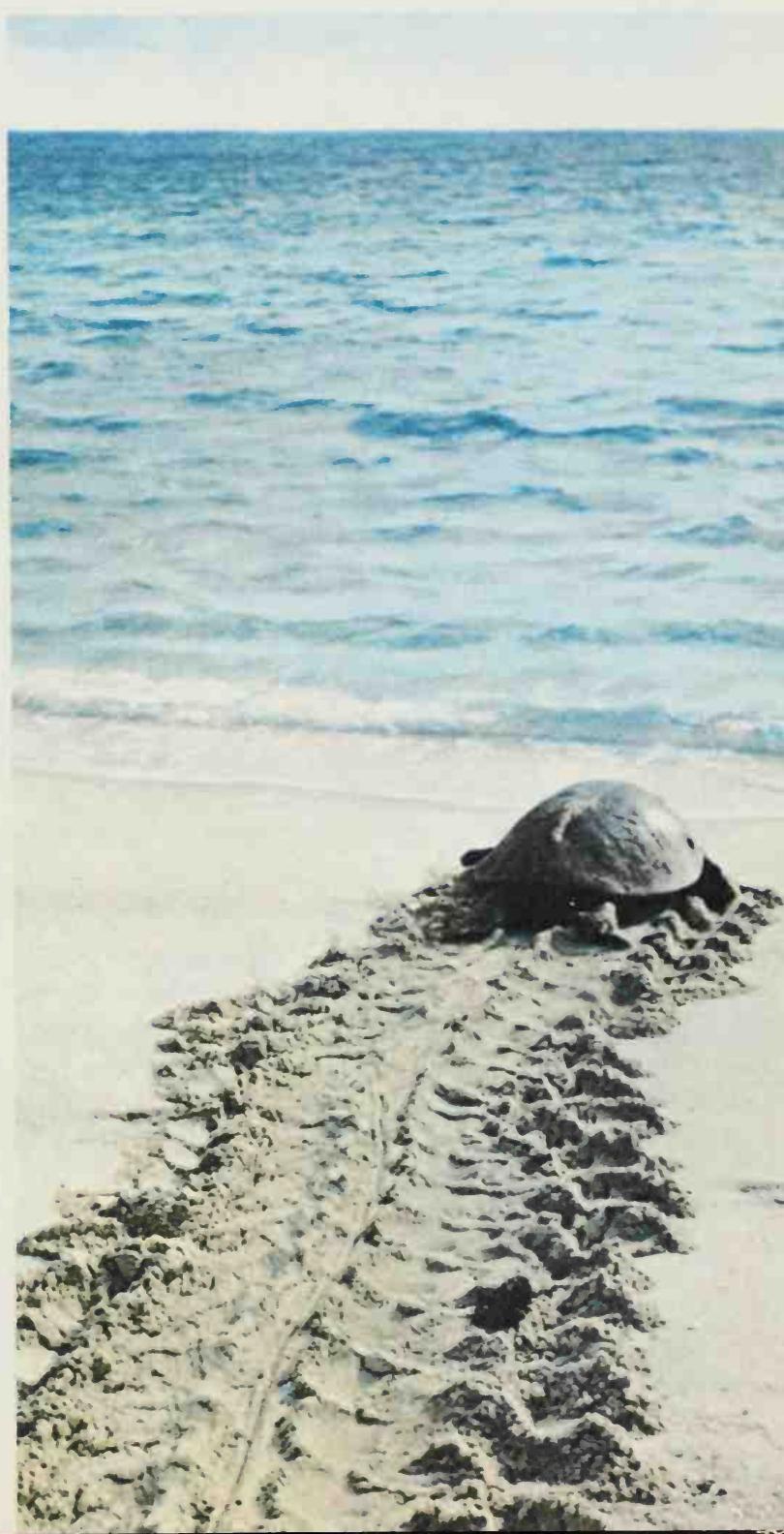
Some people think that if they touch a toad they will become covered with warts. Don't believe that old tale! The "warts" on a toad's skin contain a poison that protects it from enemies. Human warts are caused by a virus, and you'll never get one from a friendly toad.

MORE STRANGE CREATURES

Well, I hope you've learned something about amphibians and reptiles. And you'll probably agree that many of these creatures are strange indeed. Before we leave these curious animals, I'd like to tell you about a few more that I find quite fascinating—and you might too.

In the waters around New Zealand is an animal that is found nowhere else in the world. Scientists call this species a sphenodon, but its more common name is tuatara. The tuatara, closely related to lizards and snakes, is the most primitive of the reptiles. Creatures of this kind

Below: A sea turtle slowly returning to the ocean. It has just laid about 100 eggs in a deep hole that it dug on the beach.





lived millions and millions of years ago and are now unknown in any other place.

The remarkable thing about the tuatara is that it has three eyes. The third eye, located on top of the head, is covered by a thin layer of skin. The eye does not see, and no one knows its function. Some scientists believe that ancient reptiles could see what was going on above them even though their heads remained perfectly still. It's possible that the third eye of the tuatara was inherited from ancestors that lived 200,000,000 years ago. So the tuatara is really a living fossil.

At first glance you might mistake a salamander for a lizard. But look again! Salamanders have no scales and no claws. They prefer cool, dark places and come out of hiding mostly at night.

Most of the salamanders found in

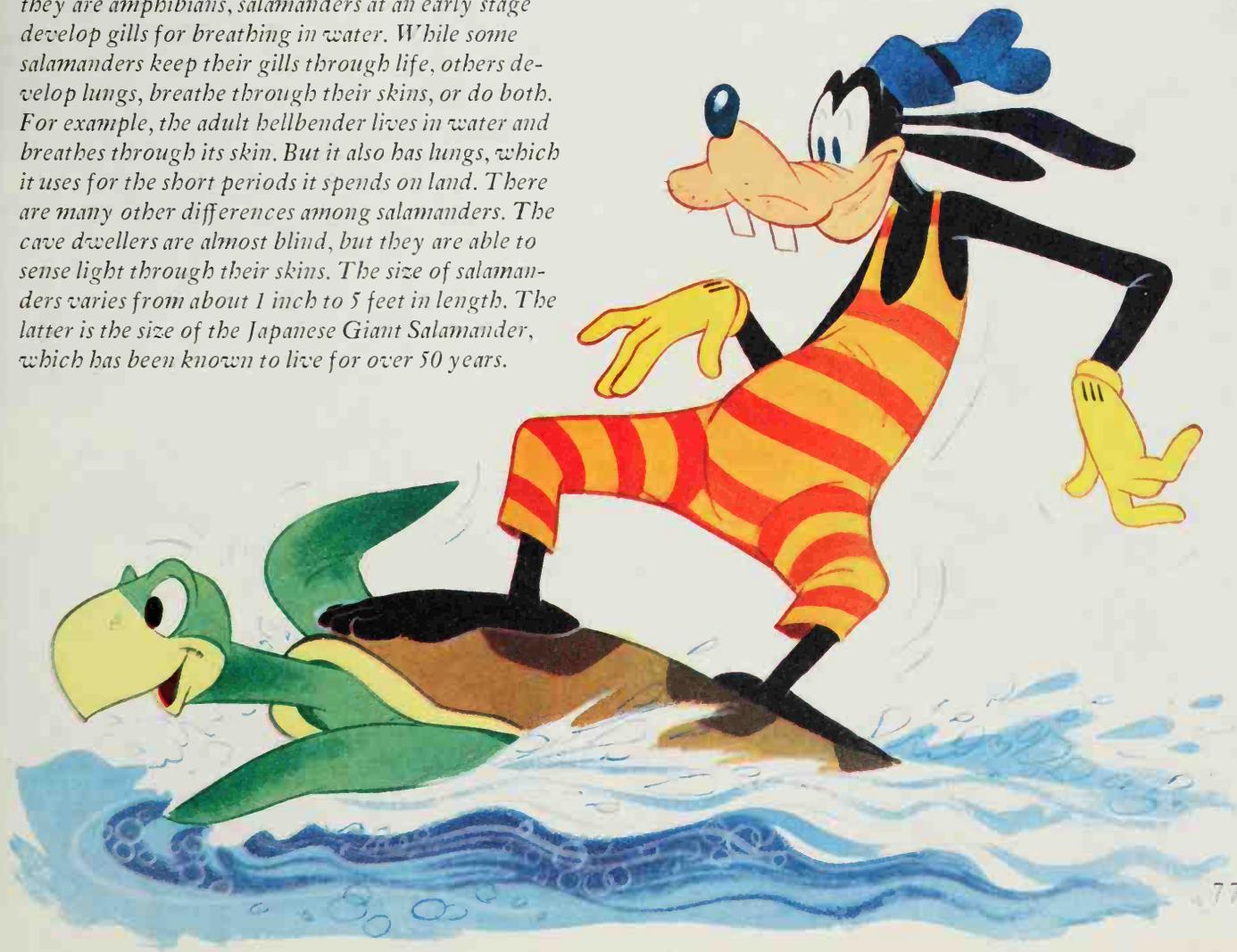
North America are tiny mole salamanders that live on land. These creatures are related to the giant Japanese variety that grows to a length of more than 5 feet.

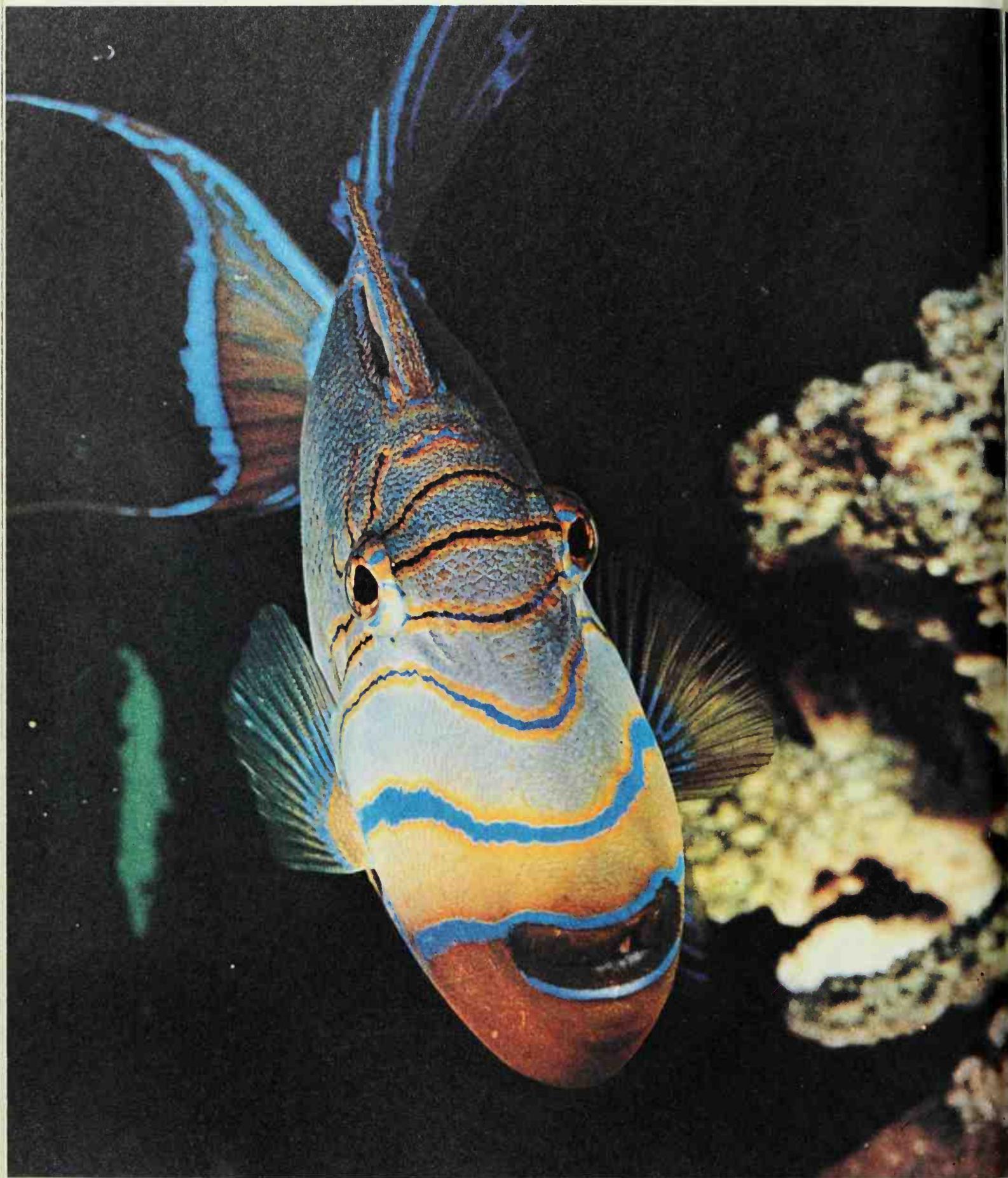
The mud puppy and mud eel, also found in the United States, are salamanders. These animals, like several others of the group, never complete their metamorphosis.

The newt is a small salamander commonly found in the United States. Some newts lead a triple life. The red-spotted newt, for example, starts life in the water. In 2 or 3 months it completes its metamorphosis and is ready for life on land. It then turns from green to coral red and is called a red eft. After a few years on land it returns to the water to lay its eggs, and its back skin changes to green once again!

Opposite page: A large sea turtle about to surface. These turtles spend most of their time in the water. As a result, over the centuries their paws became flippers and their body shape streamlined for swimming. About the only time these turtles spend on dry land is when they lay their eggs, which usually happens after sunset. However, some kinds of sea turtles occasionally go ashore to sun themselves. A giant sea turtle can weigh well over 500 pounds. The enormous weight of its shell and the effort the turtle must make to lift it in order to breathe causes it to emit painful grunts. The shell also forces the turtle to move extremely slowly, which makes it easy game for hunters. The turtle cannot draw its head into its shell, and once it is turned over on its back on land, it cannot right itself. The green sea turtle has long been hunted for the flavor of its meat.

Right: A tiger salamander. The salamanders are often mistaken for lizards, but they do not have the lizards' scales or claws. Salamanders are voiceless animals with a highly developed sense of smell. They also are able to regrow many parts of their bodies. There are many kinds of salamanders. Some live in the water—in rivers, ponds, and streams. Others live in underground caves or on land under logs and rocks. Since they are amphibians, salamanders at an early stage develop gills for breathing in water. While some salamanders keep their gills through life, others develop lungs, breathe through their skins, or do both. For example, the adult hellbender lives in water and breathes through its skin. But it also has lungs, which it uses for the short periods it spends on land. There are many other differences among salamanders. The cave dwellers are almost blind, but they are able to sense light through their skins. The size of salamanders varies from about 1 inch to 5 feet in length. The latter is the size of the Japanese Giant Salamander, which has been known to live for over 50 years.





FISH: A WORLD OF BLUE LIGHT



Boys and girls, come along with Grandma Duck while I "drop in" to visit my very close friends—the fish. Since we'll be traveling underwater, we'll need some special equipment. Bring along a rubberized suit, flippers (luckily I have my own built-in pair), and a face mask. Don't forget your aqualung. This high-pressure cylinder contains your valuable supply of air. Please don't bring any harpoons or spear guns. The fish are our friends, and we should try not to scare or harm them.

There are more than 20,000 different kinds of fish living in our oceans, lakes, streams, and bays. They can be found in the cold Arctic waters as well as in the warm tropical waters near the equator. Fish come in many shapes and sizes. Since they spend their life in water, fish have a special system of breathing. Water is taken into their mouths. The fish then draw the sides of their throats together. This forces the water over the gills, which are located inside hollow places on each side of the body just in back of the head. Before the water passes out through the gill openings, oxygen is taken from the water and is carried to all parts of the body of the fish.

The appearance and way of life of each

sea creature varies according to where it is found. On the high seas the great majority of fish have a long, streamlined shape, which permits them to swim with speed and ease. This is important for their safety. There are very few good hiding places in mid-ocean and speed is necessary if a fish is to flee from his enemies. Fish that don't swim very fast have other means of defense. Some produce electricity or poisons. Others have thorns or an armorlike covering. Many fish resemble seaweed in shape and color, so they can easily hide among the underwater plant life.

For fish, coloring is also an important factor in the fight for survival. Those that live near the surface of the water usually have backs that are dark green, black, or steel blue. The lower parts of their bodies are silvery or white. When you see these fish from above, they conveniently blend into the deep blue of the sea. If you look at them from below, they seem to be a reflection of the sunlight shining through the water.

Fish that live near the bottom of the ocean are generally silvery or red. They blend in with the darkest and deepest regions of the mysterious underwater world.

OUR FRIENDS WITH FINS

Donald once told me that fish don't have arms, but that they do have feet. What he meant to say was that fish use their fins as feet. Fins help a fish to move about in search of food—and to avoid becoming a hungry sea creature's dinner.

Most fish have two kinds of fins—medians (single) and lateral (paired). The median fins are called the caudal, the anal, and the dorsal. The double, or paired, fins are the pectorals and the ventrals. In some species of fish the double fins give the appearance of real wings. The flying fish found in the seas near the equator make long leaps out of the water and skim along the surface for quite a distance. They are able to do this because of the mighty thrusts of their tail fins. Some fish "walk" along the bottom of the sea using their pectoral fins as "feet."

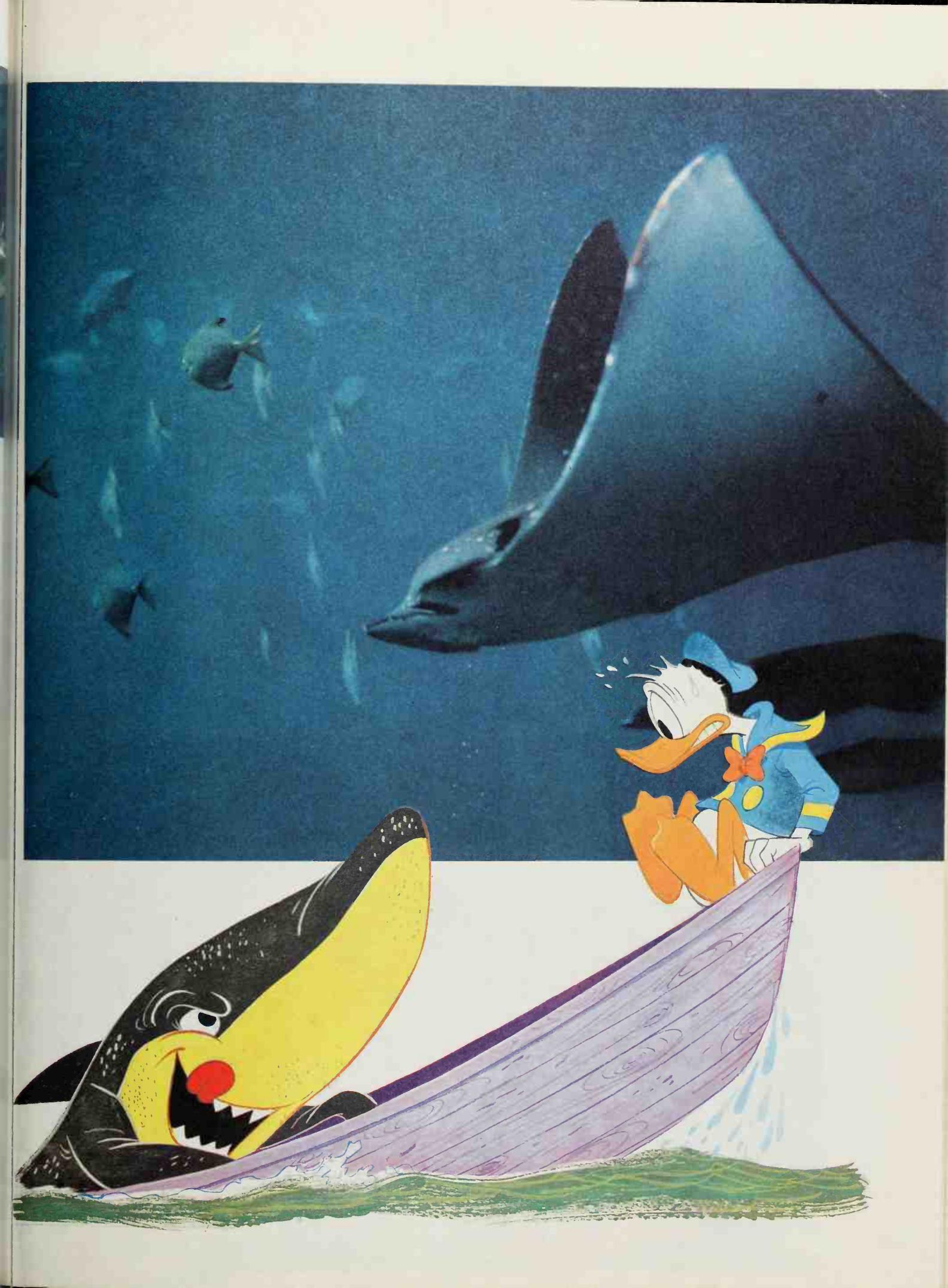


Above: A shark, one of the world's creatures most feared by man. The aggressive and consequently dangerous ones are usually found in warm seas.

Below: A school of barracuda, a fierce and savage fish that lives in tropical waters.

Opposite page: An eagle ray, so-called because its wide fins resemble wings and enable it to "fly" through the water. Rays are related to sharks.

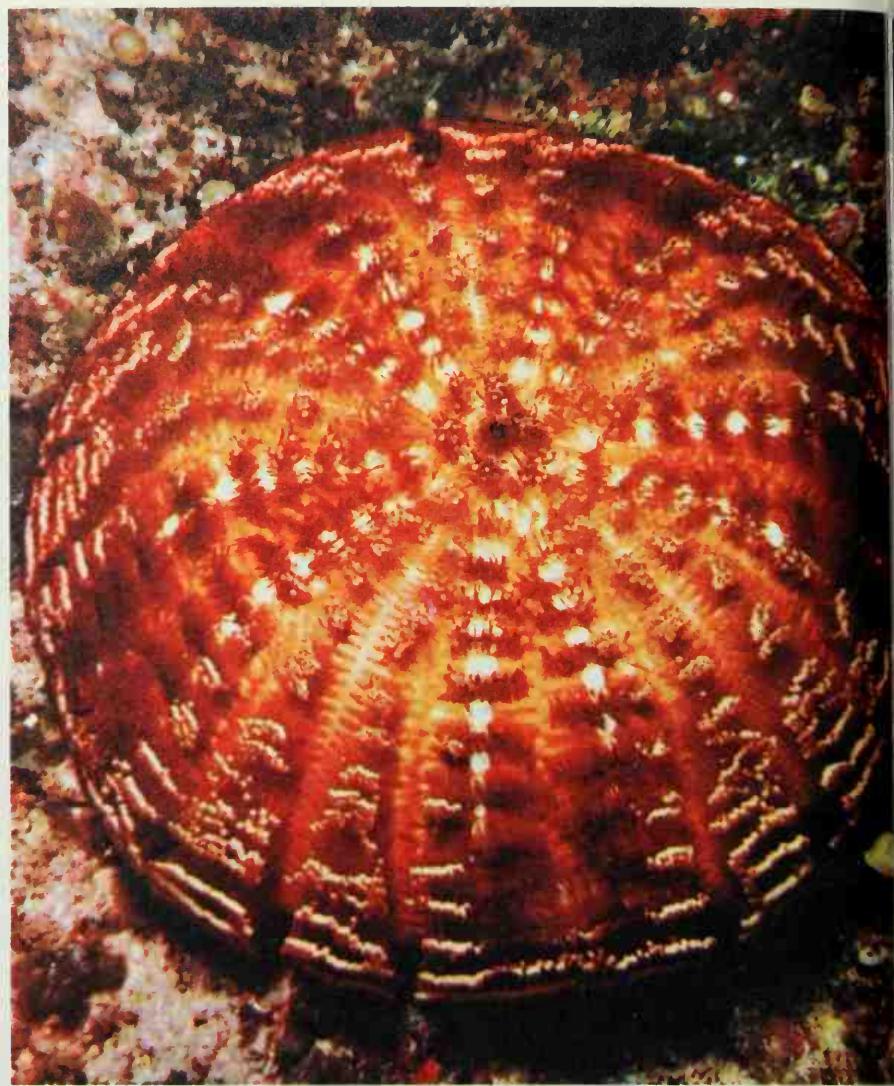




Right: A red sea urchin. Sea urchins belong to the same class of animals as starfish, sand dollars, and sea cucumbers. They are widely found along coastlines and on sea bottoms, where they feed on seaweed and on living and dead animal life. In turn, they serve as food for other sea creatures and for those people who consider them a great delicacy. The sea urchin's mouth, which is equipped with five small but sharp teeth, is located on the underside of its body. Sea urchins come in a variety of sizes and shapes. Some are small; others grow up to 6 inches or more in diameter. A common variety has long, sharp spines.

Opposite page, above: A hammerhead shark, a species dangerous to man. It may reach 10 feet in length. It is found in tropical and subtropical waters where it is sought after by fishermen for its meat, which some people prize for food, and for its skin, which makes fine leather.

Opposite page, below: A sawfish. This creature is a ray but resembles a shark in appearance. Its sawlike snout, which may be 4 or 5 feet in length, is a handy tool for digging into the sandy ocean floor in search of food. It is also a formidable weapon. The sawfish often attacks large schools of fish, killing them with violent thrusts of its saw.

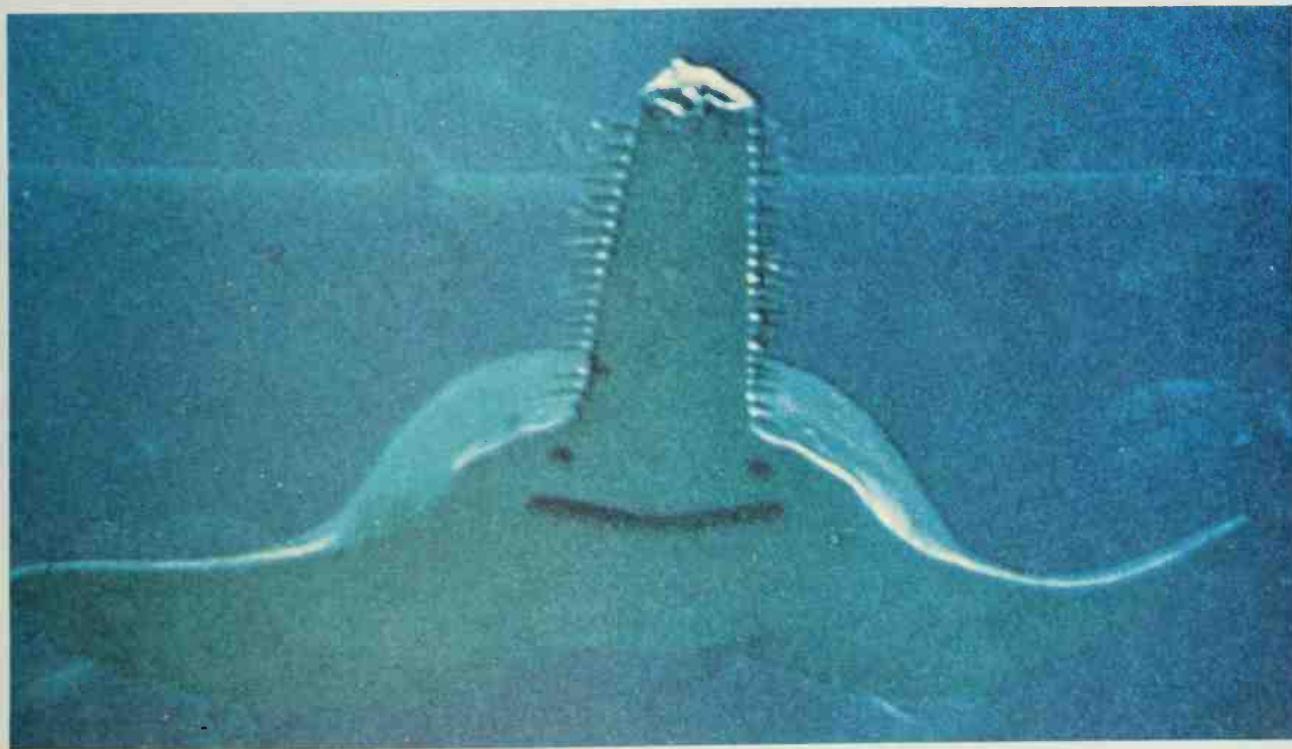
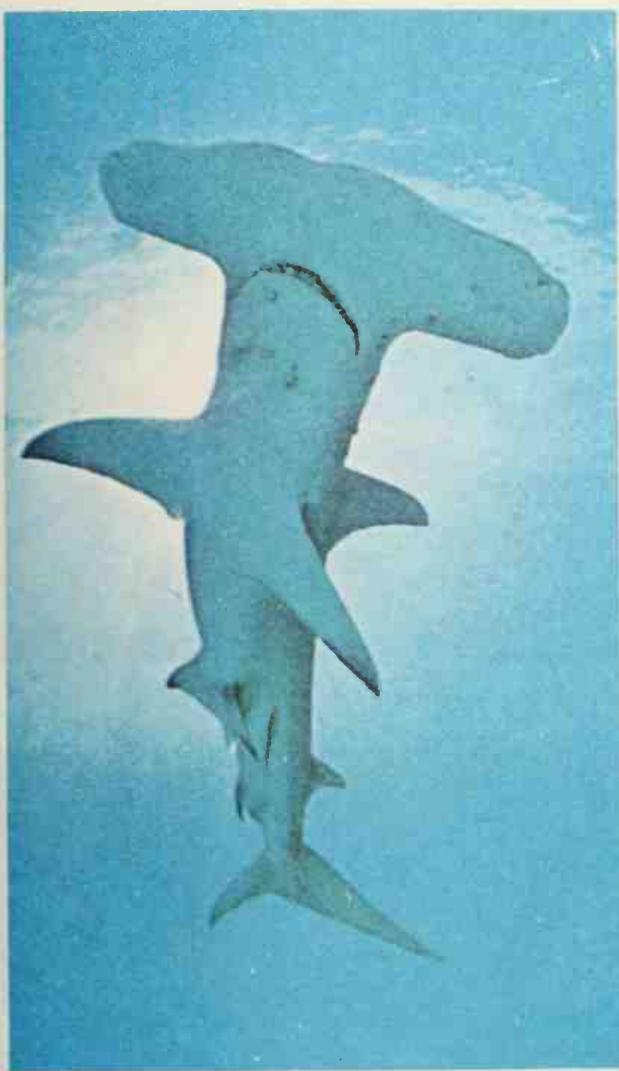


DANGER: ENEMIES AHEAD

I mentioned earlier that many kinds of fish rely on speed to escape from danger. Some fish also have particular shapes and colors or certain habits that they use to protect themselves. There is a variety of strange fish, however, that has a unique built-in defense system. The electric eels found in the rivers of South America, and their relatives, the electric rays, are equipped with body organs that produce electricity. The shocks generated by these organs are so powerful that they paralyze the fishes' prey.

On our underwater travels, we must be sure to avoid the scorpion fish and the lionfish. These dangerous creatures use poisonous stingers or spikes extending from their bodies to ward off enemies.

The puffer, (sometimes called a blow-fish), is an unusual sea creature. If it senses danger, the puffer will inflate itself by filling an internal sac with air or water. When this is done, the puffer looks something like a ball covered with spikes.



LIFE AND BREATH

While we're on our underwater journey, let's take a closer look at some of our watery friends. We can begin with a very important feature—the mouth.

Fish mouths and teeth differ greatly, depending on the kinds of food the fish eat. Fish that eat other fish—the barracuda, piranha, and shark—have a large mouthful of very sharp teeth. We'd be smart to avoid these creatures! Our finned friends that eat plants from the bottom of the sea have very small mouths and cutting teeth. The fish that have shellfish or lobster for dinner usually have strong



The sea horse got its name because of its appearance. Its head resembles that of a horse and it carries itself erect when it swims. Its body is covered with irregular bonelike plates. The male sea horse has a pouch in its belly in which it carries the eggs of its young until they are born. The eggs are deposited by the female.

Top: A clownfish. This tiny, colorful creature is a member of the damselfish family.

Below: The butterfly fish offers a good example of protective coloring: its real eyes are camouflaged by the vertical stripe; the false eyes are the round spots near the tail.

molar teeth. This enables them to grind their food. Our little friends the sardines feed on microscopic organisms in the open water. They have no teeth, but they do have a fine straining apparatus in their gill cavity that filters the water.

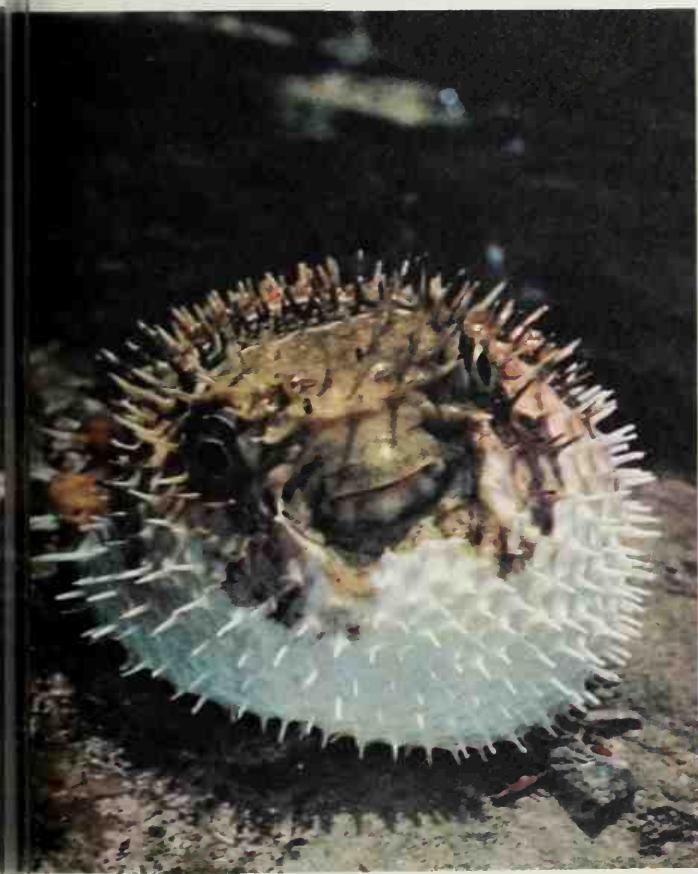
The sturgeon has a slender body, which is covered with rows of long bony scutes. Beneath its long snout lies a small toothless mouth with thick lips that allow the sturgeon to suck food. The lamprey, a long eel-like fish, has a large oval mouth and horny teeth. The lamprey attaches itself to other fish with its mouth and gorges on blood.

And speaking of mouths, we shouldn't

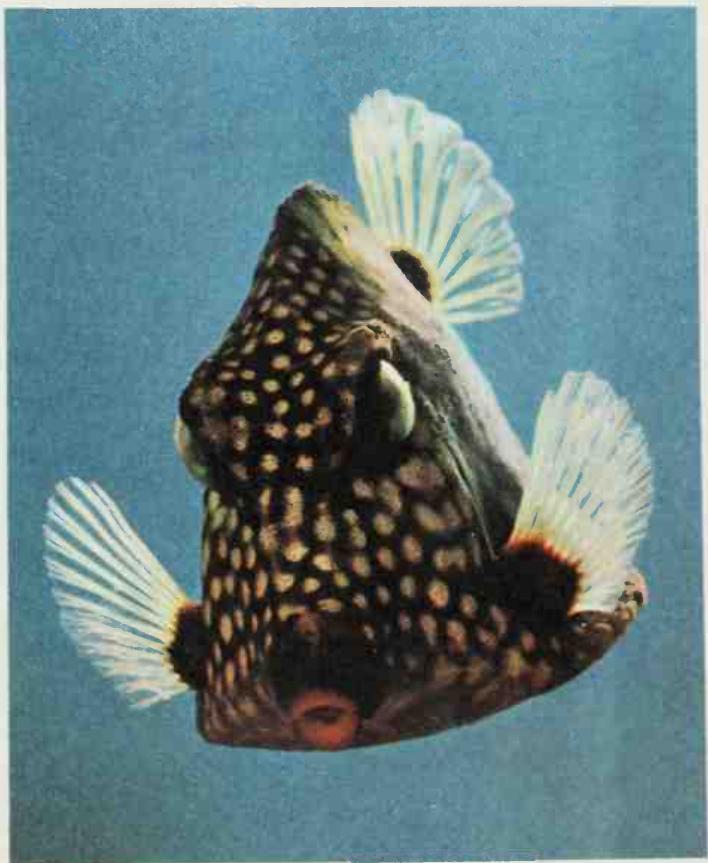
forget the brightly colored parrotfish. The large round head of this underwater creature ends in a parrotlike beak! These fish can be found in and around coral reefs, where they feed by biting off plant growth from the coral.

Let's continue our trip through this colorful underwater circus and look just beyond the mouths of the fish. We should examine the ways in which Mother Nature has chosen to equip the fish for their lives underwater. One of the most unusual and interesting organs is the air bladder. It is similar to our lungs.

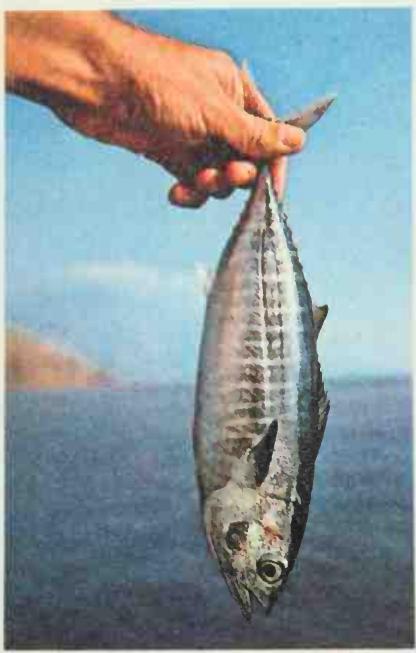
All fish, except the lampreys and sharks, have air bladders. These organs,



The porcupine fish, or balloonfish, is found in tropical seas. At the first sign of danger it inflates itself with air or water into a balloon shape (as shown here) and presents its sharp spines to an enemy. Its beak has two sharp teeth, one upper and one lower, and its flesh is poisonous. It may measure 3 feet or more in length.



The trunkfish owes its name to the armor, or trunk, which covers it. The armor is made of bone and serves to protect it against other hungry fish. Because of the rigidity of the armor plating, it is a very slow swimmer. There are many species of trunkfish. One is called the cowfish because of the hornlike projections over its eyes.



This small tuna would be dwarfed by its larger cousins, some of which may exceed 10 feet in length. The tuna's streamlined shape enables it to move through the water at great speed—sometimes faster than a ship. It lives on the high seas and travels in large schools. Tuna is an important food fish. The chief commercial varieties are yellowfin, bluefin, albacore, and skipjack.

however, are not used for breathing. If you remember, we discovered earlier that most fish breathe with the aid of their gills that extract oxygen from the water. The lung, or air bladder, in fish is used to keep them afloat! When the bladder is full of air, the fish floats. When it is emptied, the fish drift slowly toward the bottom of their watery home. Sometimes this lunglike organ is used by the fish to produce sound.

AN EYE FOR TROUBLE

In many ways, the eyes of a fish are similar to your own eyes. There are differences, however, because a fish uses his vision in water while human beings see in air. The anablep, a strange little fish swimming in the waters of Central and

South America, has a most unusual eye structure. This fish swims at the surface of the water. Each eye is divided into two lenses and two retinas. The top half of both eyes is adapted to seeing in air, while the lower half is used for underwater viewing.

Sometimes fish with bad eyesight and a poor sense of hearing have to depend on their other senses. When they are searching for food or when danger threatens, they must rely on their sense of smell.

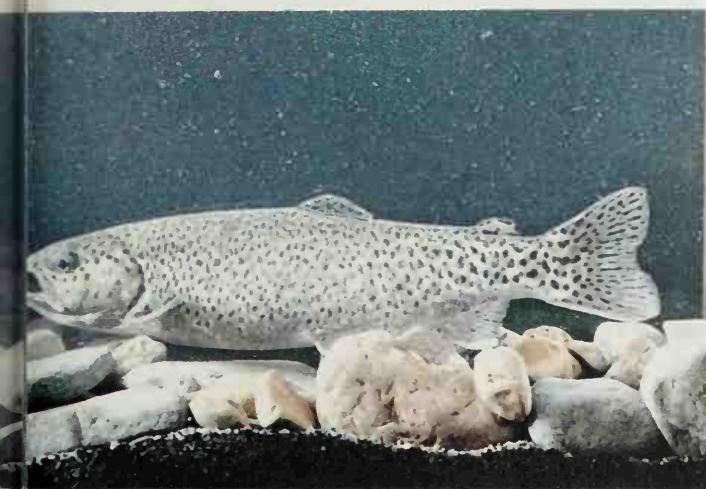
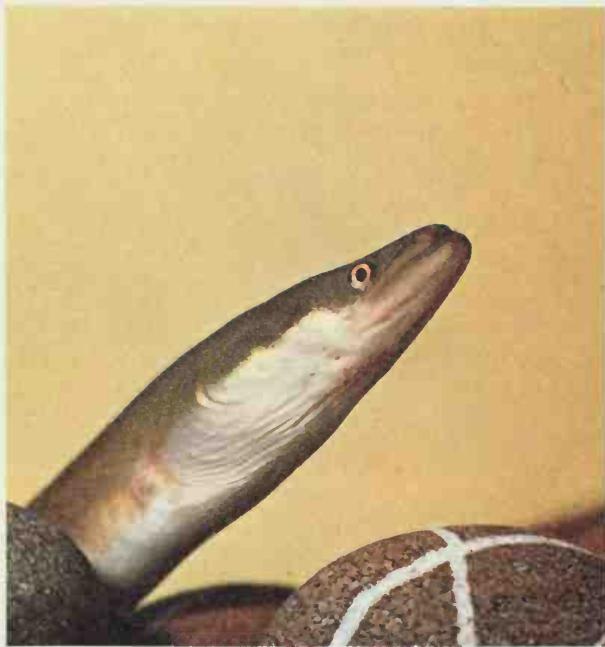
There is another sensing system called the lateral line system. It is found only in fish and in a few amphibians. The lateral line is a row of tubes and pores covering a nerve that runs along the entire length of the fish. This sensitive organ feels even the slightest vibrations. So when fish cannot see or hear their enemies in the murky waters, the lateral line acts as a warning signal.

CARE OF THE YOUNG

Most of our underwater friends lay a great number of eggs. Every year, the female herring may deposit 20,000 to 40,000 eggs. However, few of them survive. This is because the herring doesn't look after these eggs.

But some species of fish take good care of their eggs. They also watch over and protect their young. The Egyptian mouthbreeder is an extraordinary parent. It carefully holds the eggs in its mouth until they hatch. After the eggs have developed, the new born fish always rush back into their mother's mouth at the slightest sign of danger.

Uncle Scrooge was a bit doubtful when he heard about the Egyptian mouthbreeder. He wondered if the female fish would swallow the eggs or the baby fish

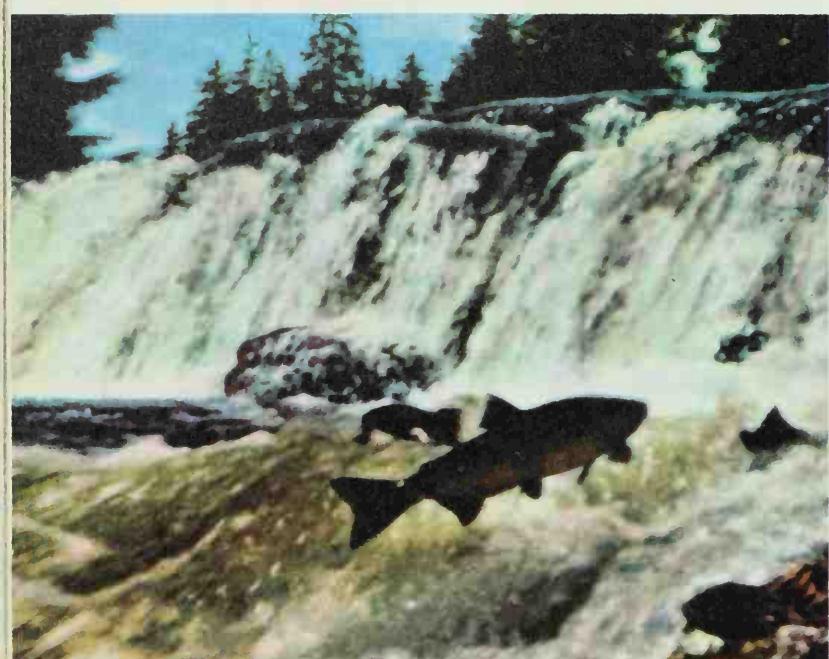


Top, right: The head of an eel. The snakelike eel differs in appearance from most other fish: it has very tiny scales or no scales at all, its fins are very small, and some kinds have no fins.



Top: A sea bass on a coral reef. The sea bass is a deep-water fish.

Below: The trout is found in freshwater lakes and streams as well as in saltwater seas. Several varieties are popular game fish. Both trout and the sea bass are excellent food fishes.

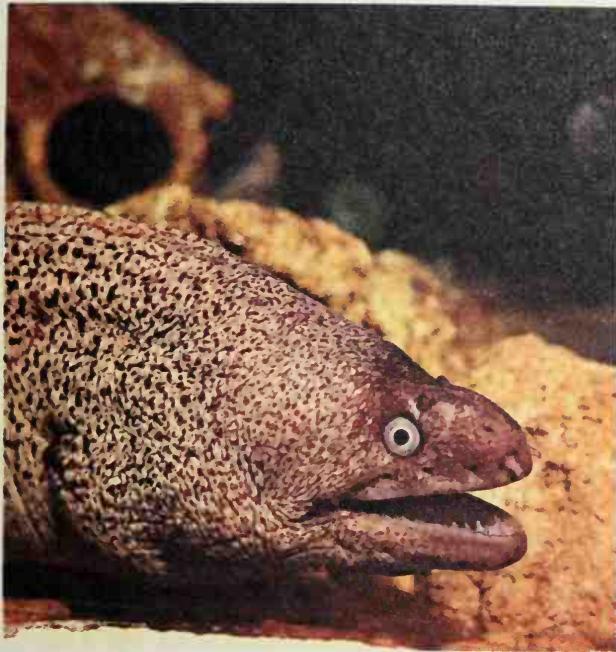


if a nice juicy worm suddenly happened by. So Uncle Scrooge conducted an experiment. He dangled a worm right in front of the Egyptian mouthbreeder. The fish quickly looked around to see that there was no danger. Then, it opened its mouth, let the eggs float out, ate the worm, and gathered the eggs back into its mouth again!

Trout also give their eggs special care. The females lay their eggs in a hole that they have carefully prepared at the bottom of a stream. They cover the hole with sand, and the eggs are left to develop into fish.

THE ADVENTURE SOME SALMON

Of all the fish we've seen on our travels, the salmon can perhaps be described as the most adventurous. They are born in freshwater streams, but spend most of their lives in the saltwater of the sea. During the breeding season, the salmon return to the mouth of the stream or river in which they were born. This is where the difficult journey begins. The salmon must swim upstream against the swiftly flowing currents,



Opposite page, left, top and below: A salmon struggles uphill through the rapids of a river to the spot where it will lay its eggs. Only some of the fish survive to reach their spawning ground.

Opposite page, top right: A tench approaches a bait cautiously. This freshwater fish is found in Europe and Asia. It lives at the water's bottom and hides in the mud at the approach of danger.

Opposite page, below right: The carp originated in Asia and it was first cultivated in ponds for food by the Chinese. It has since spread throughout the world.

Above: A moray eel.

leaping over the rapids and waterfalls that lie in their path. They also risk being caught by fishermen. Along the way a male salmon selects the female that will be his companion. When they arrive at the spawning grounds, the female swims to the bottom of the stream and gouges out a hole about 6 inches deep. It lays its eggs in the small hole and covers them with sand. The eggs are protected as they develop on the stream bottom. After the breeding season has ended, many adult



salmon die, but some survive and return to the sea.

The salmon eggs remain safely in the sand until they hatch. This process usually takes about 6 months. When the baby salmon are 2 years old, they, like their ancestors before them, start their long journey to the sea. After 2 or 3 years of saltwater life, the now fully-grown salmon will begin their fascinating and mysterious journey back to the spawning grounds of their birth.

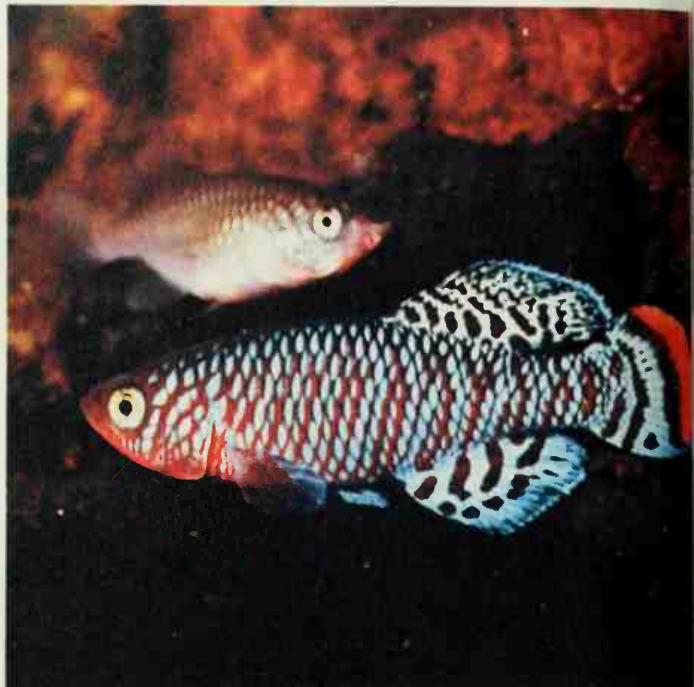
THE TALE OF AN EEL

Boys and girls, before we swim one stroke farther, let's stop and rest. Grandma Duck has an interesting tale to tell you about those snakelike sea creatures—the eels.

For years, the life story of freshwater eels was a mystery. No one knew where or how an eel reproduced. Then about 50 years ago a Danish naturalist discovered very small, newly hatched eels in the Sargasso Sea southeast of Bermuda. After long and careful research, we now know that it is here, in the North Atlantic Ocean, that American and European freshwater eels come to spawn. Just imagine, if you can, an eel traveling from a lake in the central United States—or a stream in the foothills of Italy—all the way to the Sargasso Sea!

Immediately after laying their eggs the adult eels die. The newly laid eggs are left to float about the ocean, drifting as part of the seaweed. After a few months the eggs develop into larvae, their first stage of life. The larvae soon leave the deep waters of the Sargasso Sea and make their way to the North American and European coastlines. The male eels stay near the coasts, while the females travel by river far inland to freshwater lakes and streams. By this time the eels have grown almost to full size. They may reach up to 7 feet in length and are usually muddy brown above and tinged with yellow on their sides.

There are still many questions to be answered about the migration of eels. For example, how do they find their way to the Sargasso Sea? It's quite a mystery! I'm sure they don't use road—er—river maps! Another of the many unsolved





Opposite page: Three examples of tropical fish. Tropical fish are prized for their striking beauty and are often found in home aquariums. The male of the Siamese fighting fish (center) is bred for sport in Thailand. The angelfish (bottom) is native to certain regions of South America.

Above: This unusual looking fish resembles a harmless butterfly, but its spines are poisonous. It is known by several names: zebra fish, scorpion fish, turkey fish. It lives among coral reefs in the Pacific and Indian oceans.

questions concerns the return of the baby eels to fresh water. I've been told that the little eels hatched from the eggs of the European eels head for Europe, and those of American parentage swim to North America. Now, how in the world do they do that? Do you suppose someone is pulling my leg?

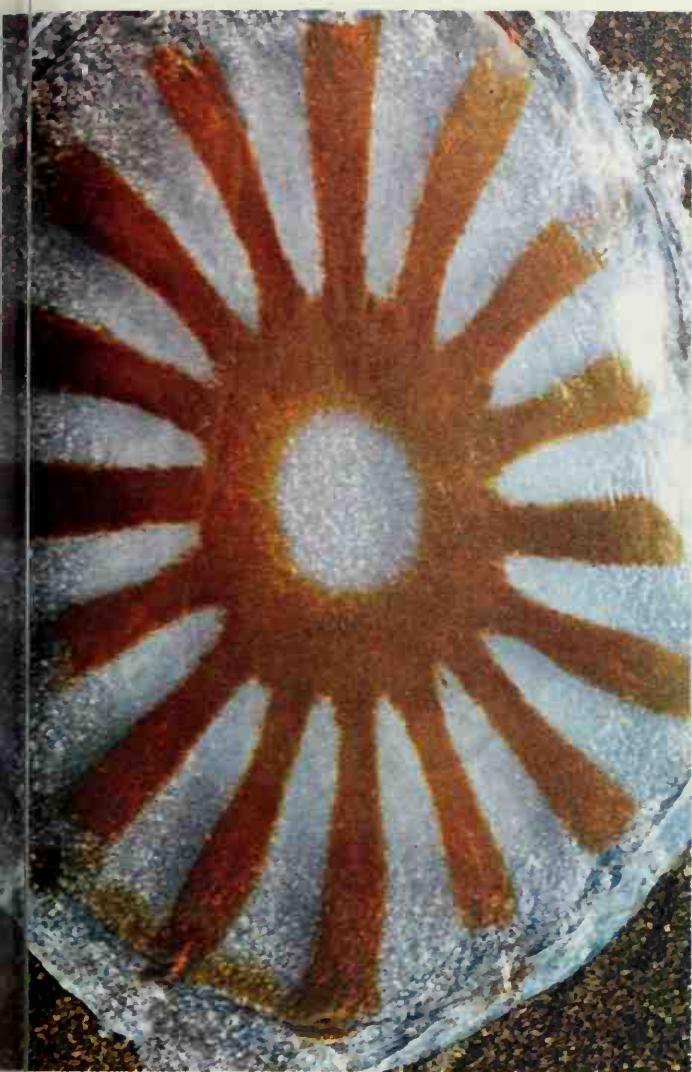
So far no one has been able to answer these questions. Perhaps one of you will study the subject of eels and startle the world some day with the solutions. And if you do, boys and girls, you may be assured that Grandma Duck will be anxious to learn of your discoveries.



Above: The tentacles of the giant sea anemone offer a home to the damselfish, although to other fish the anemone is poisonous.

Below: A fish conceals itself from danger in the sandy sea bottom, exposing only its eye. Other fish hide there to ambush their prey.

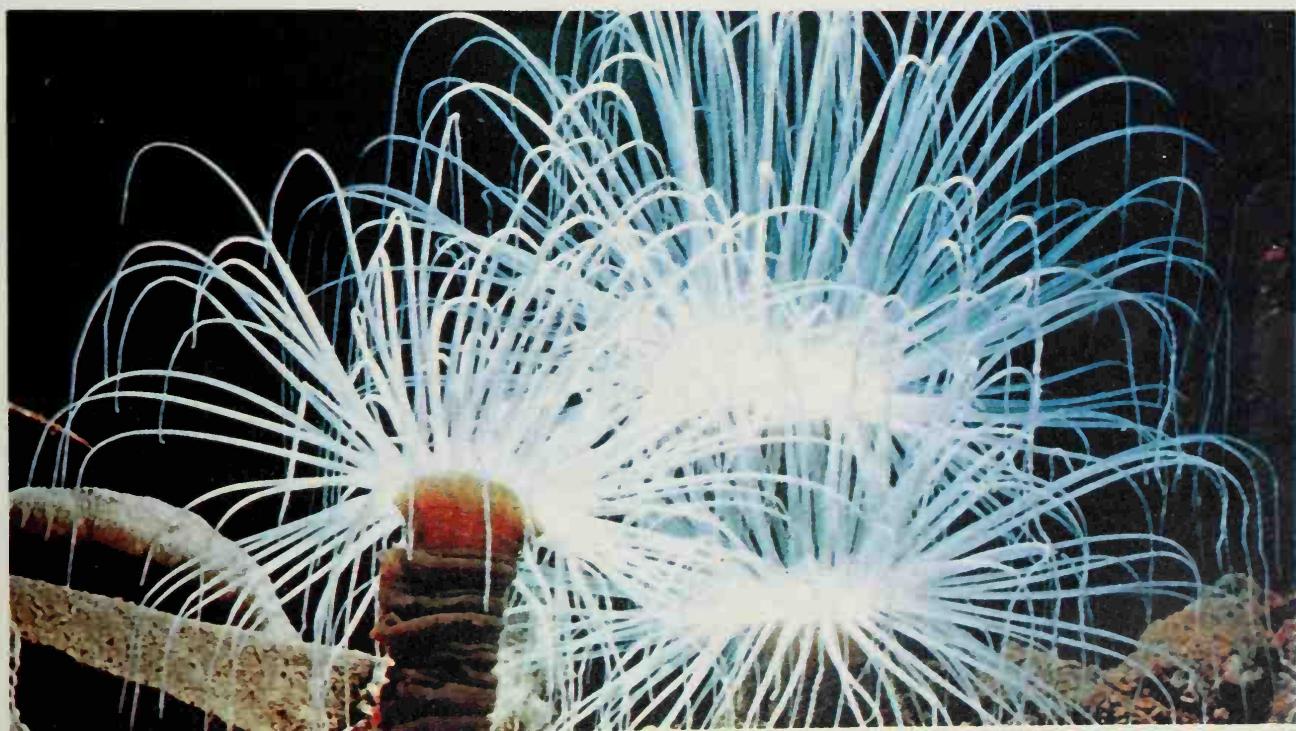


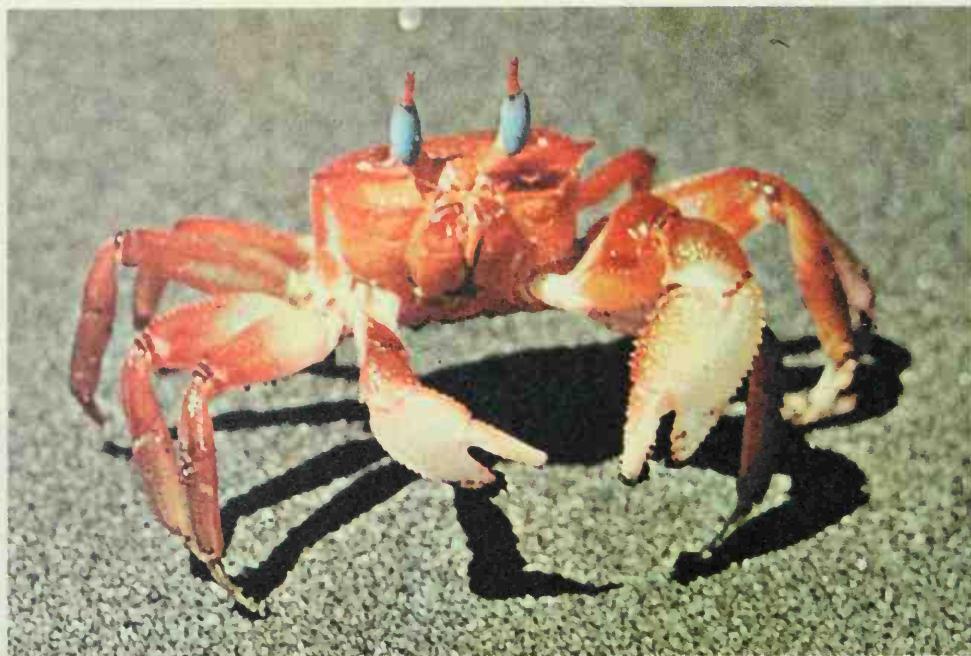


Left: A large jellyfish. Beneath the hollow, cup-shaped body dangle long tentacles with which it paralyzes its prey. This form of the jellyfish is called a medusa, after the creature of Greek mythology whose look turned men to stone.

Below: A mass of fish eggs that has taken the shape of a flower.

Bottom: The hydra also takes its name from a monster of Greek myth. The mythical Hydra had nine heads; if one was cut off, a new one grew. The real-life hydra also regrows parts that are lost. The jellyfish, sea anemone, and hydra are related.



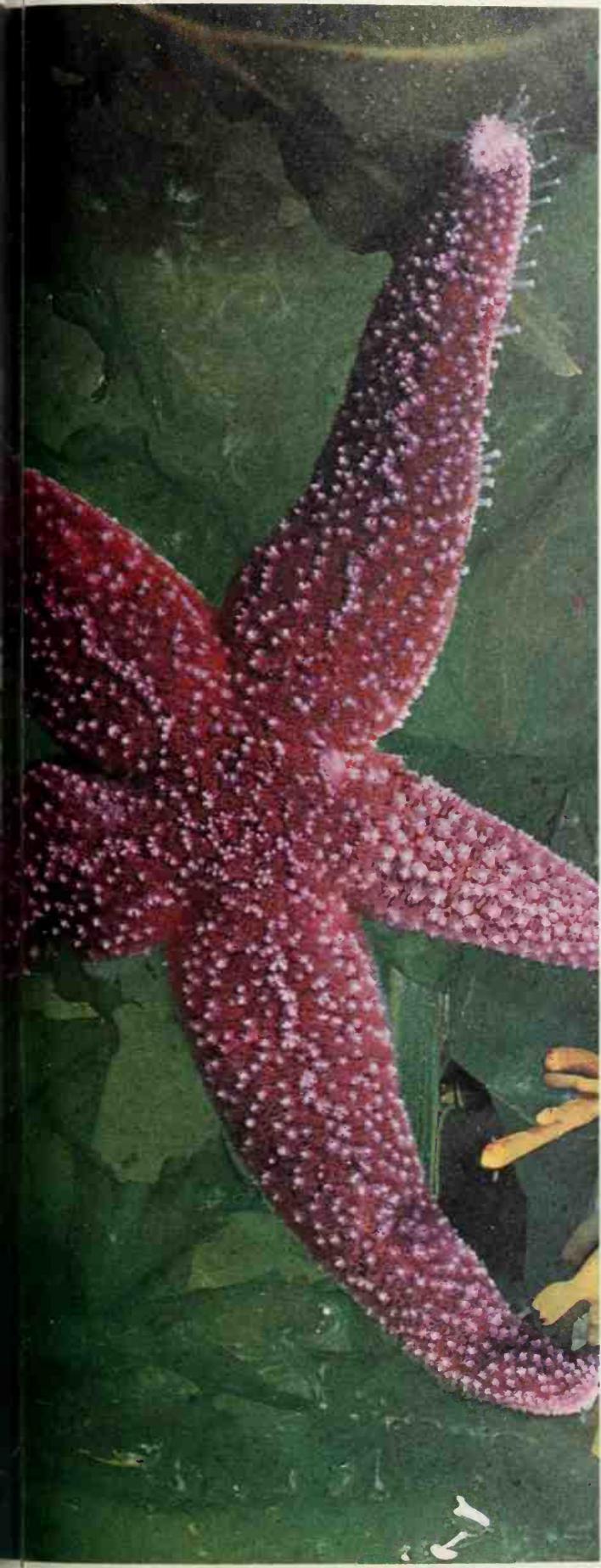


Above: A red crab. In spite of its menacing appearance, the crab is really a very timid creature.

Left: Probably the most often seen variety of sea urchin. The protective spines are poisonous, but the sea urchin's mortal enemy, the triggerfish, cuts through the spines with its sharp teeth and makes a hearty meal of it.

Opposite page: The common starfish. If it loses one or more of its arms, it grows new ones to replace them.





MORE WONDERS OF THE SEA

Our underwater adventures are almost at an end. Before we head for dry land, however, let's take a quick look at some of the wonders we've missed along the way. It is only fitting that we stop to visit the mollusks, since they are the largest group of water animals.

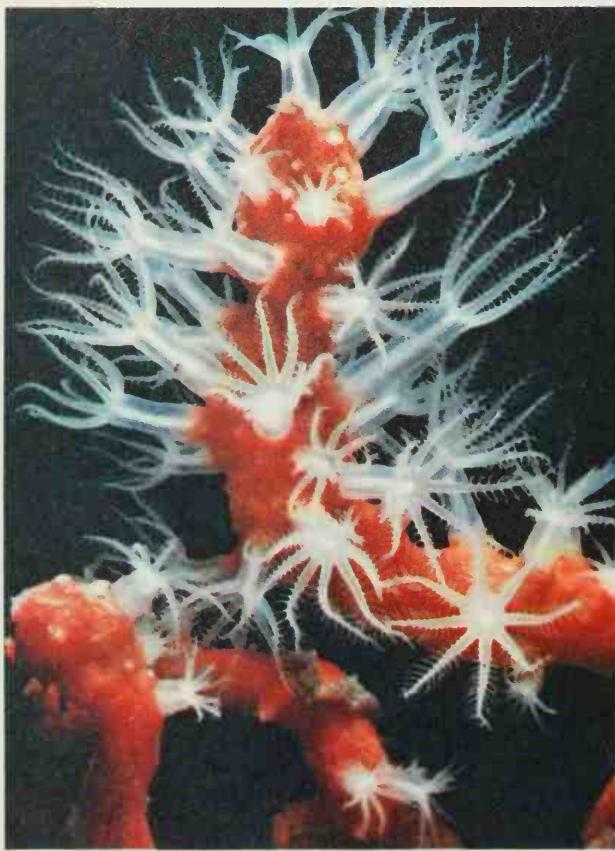
Mollusks are soft-bodied animals that have no bones. Octopuses, squids, cuttlefish, oysters, and snails belong to this unique family. All mollusks are covered with a thin mantle, or cloak, of flesh. Oysters and snails wear a protective coating of hard shell. You'll have to forgive me, boys and girls, but I always become upset whenever I mention the word "oysters." As you know, pearls, one of the most beautiful of all precious gems, are made by certain kinds of oysters. Many years ago Uncle Scrooge promised me that as soon as he made his first million dollars, he would buy me a strand of real pearls. Well, needless to say, I'm still waiting.

If we swim just a few more feet and turn to the right, we'll run into the crustacean family. You probably know them by their more familiar names: crabs, shrimps, and lobsters. The word "crustacean" means "covered with a hard crust." And that certainly describes our sea friends!

Our vast oceans are also home to a great number of unusual creatures. Sea urchins, sea cucumbers, jellyfish, and madrepores all find the seas an ideal place to live. And you must agree their presence certainly does contribute to the mystery and beauty of the underwater world.

At first glance many of the strange inhabitants of the sea do not look like animals, but they are. Often they do not even move—except in their larval, or first, stage of growth. They spend most of their life just clinging to rocks or to the sea floor. The sea anemone is a perfect example. This brightly colored plantlike creature is really an animal. You would have to look closely to make sure

—but not too closely. You see, the sea anemone must be handled with extra care. The numerous tentacles that surround its mouth are poisonous. Unlike many of our other underwater friends, the sea anemone does not search for food. It patiently waits for the food to pass by. When a small fish swims near, the sea anemone grabs it with its tentacles, paralyzes it with poisons, and then quickly



Left: A branch of coral. The corals belong to the same group of animals as jelly fish. They live in colonies and their skeletons form the great coral reefs of the Pacific Ocean.

Above: A group of sea slugs. Although shell-less, they are related to animals with shells such as snails and clams.

Opposite page: Crabs are often found on beaches or in shallow waters.



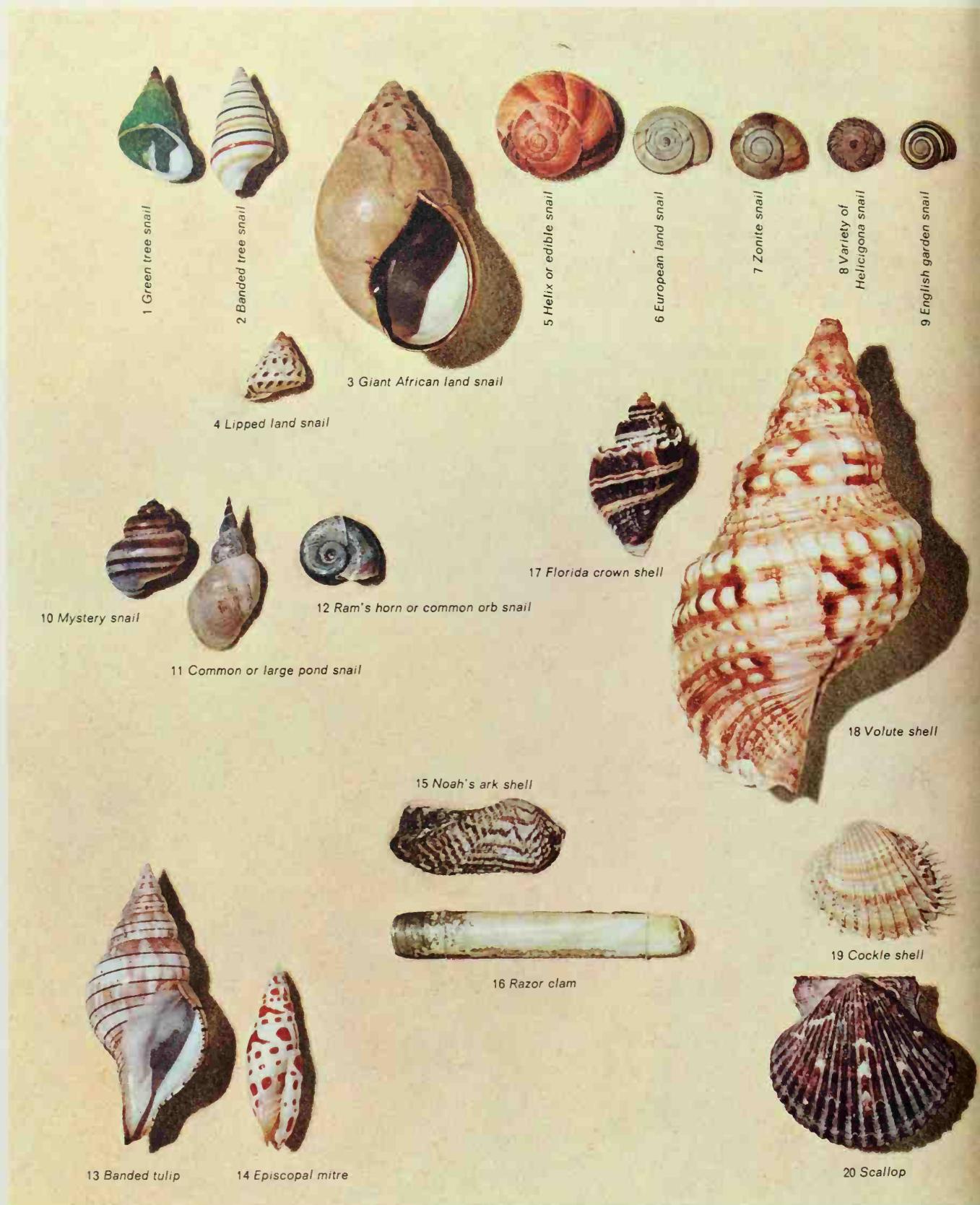
stuffs the fish into its mouth. I must say, those aren't very good table manners!

The starfish is a rare beauty. It is a very fast and able hunter and moves about in a strange way. The underside of each arm has many hollow, fingerlike parts. They are called the tube feet. Each of these feet has a small disk-shaped sucker at the end. As the starfish moves over rocks or the floor of the sea, the tiny feet

act as suction cups. Frankly I think that ordinary feet—human or webbed—are a much easier form of transportation.

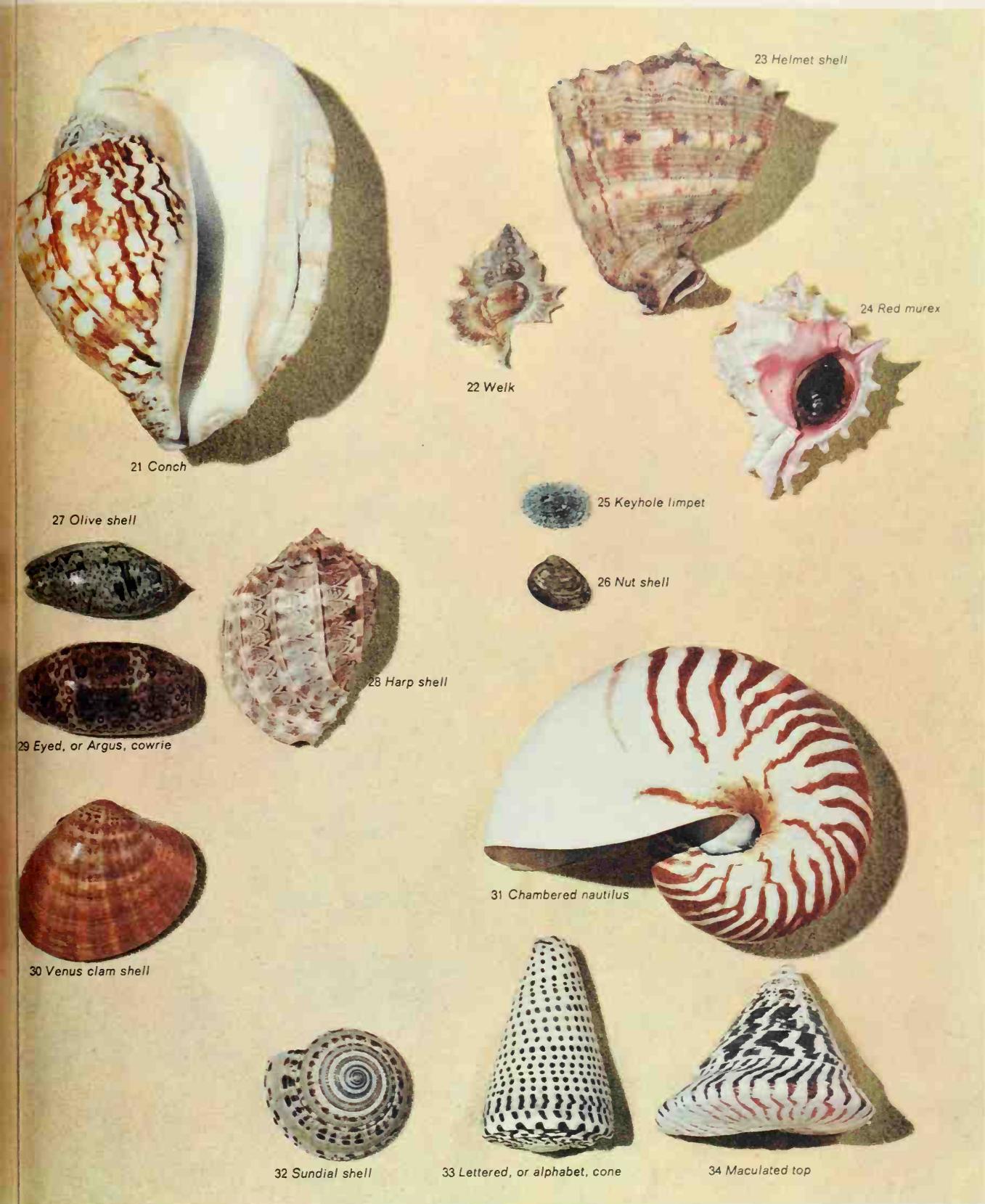
Speaking of feet, it's time we put ours to use again. Swimming underwater was exciting and interesting, but awfully tiring. However, there are still many wonders left for us to discover on dry land. Just stay with Grandma Duck and she'll show you the world!





These shells were once the homes as well as the defensive armor of various kinds of mollusks. The mollusks form one of the chief divisions of the animal kingdom. There are many thousands of

kinds. Most have shells, but some, such as the octopus and sea slug, do not. Some varieties, such as clams, oysters, and cockles, have double, hinged shells; they are called bivalves.



Shells are formed by secretions from the mollusk's body. They are made up of three layers. The shiny inner layer is called mother-of-pearl. The shape of the shell varies greatly, depending

on the animal to which it belongs. Shells numbered 1 through 9 belong to land animals; from 10 to 12 are shells of freshwater mollusks; and from 13 through 34 seashells.



INSECTS



Were you ever by yourself in the country on a bright June day, with the feeling that you were the only one in the world? Well, let Grandma Duck tell you, you were not alone. You were surrounded by thousands of tiny animals we call insects. There are more than 800,000 species of these insects, and hundreds more are discovered every year.

The body of an adult insect has three main parts—the head, the thorax, or chest, and the abdomen. I must say “adult” because when an insect hatches from the egg, it may look entirely different in shape and color from the full-grown insect. Almost all adult insects have a pair of feelers, or antennae, at the front of the head. Most of them have one or two pairs of wings.

Every adult insect has six legs, no more, no less. This is the one sure way of being certain that an animal belongs in the insect class. A spider has eight legs, so we know that it is not classed as an insect.

An adult insect wears its skeleton outside its body in the form of a hard outer coat. This tough shell is light enough not to prevent the insect from flying. The skeleton acts like a raincoat and keeps water from soaking into the body. More

important it keeps the body from losing water. It helps the insect live through long rainy spells and through long dry spells. It protects the insect from heat and cold and from some of its enemies.

FROM CATERPILLAR TO FLYING FLOWER

The prettiest of all insects are those flying flowers, the butterflies, and their less colorful cousins, the moths.

You must have at some time tried to touch those soft wings. Did you find that something like fine dust came off on your fingers? This dust comes from row upon row of tiny scales that cover the wings. It is these scales that make the lovely designs of color and light.

I told you that many insects look very different when they are young. As soon as a baby duck is hatched from the egg, you can tell it is a duck. But most insects have to go through four distinct shapes as they grow from egg to adult. A worm-like creature called a larva develops from the tiny egg. When the larva has grown as big as it will grow, it attaches itself to a twig or any other place suitable for a long rest. We call the insect in this

resting stage a pupa. The pupa develops a covering called the pupal case. Inside this case, during the long pupal rest, the body of the adult insect takes shape. Many insects, however, skip some of these stages.

The butterfly and the moth take all four forms—egg, larva, pupa, and adult. Even if you haven't seen the tiny eggs, you surely have seen these insects in their second stage. The crawling caterpillars are the larvae of butterflies and moths.

Caterpillars eat so much that their skins become too tight. All they have to do is split their skins and crawl out in new skins that fit better. They do this four or five times before becoming pupas.

Moth larvae spin thin houses, or cocoons, around themselves for the pupal stage. A butterfly also develops a similar covering.

Once the adult body is fully developed, the pupal case opens. Out comes the adult butterfly or moth. The wings quickly grow strong in the fresh air. In a few hours, the adult insect can fly away.

HIDING BEHIND COLOR

All of you know that Grandma Duck is good at finding Donald when I need him to do an errand. But I don't think I would be so good at finding some insects behind their clever disguises.

Insects have many enemies even among other insects. One way they protect themselves is to fly or scamper away as fast as they can. But sometimes the best defense is just to hide where they can't be seen. Believe it or not, they hide behind their own coloring.

Many insects disguise themselves by looking exactly like their surroundings. Some butterflies and moths have the coloring and the pattern of a twig or a dead



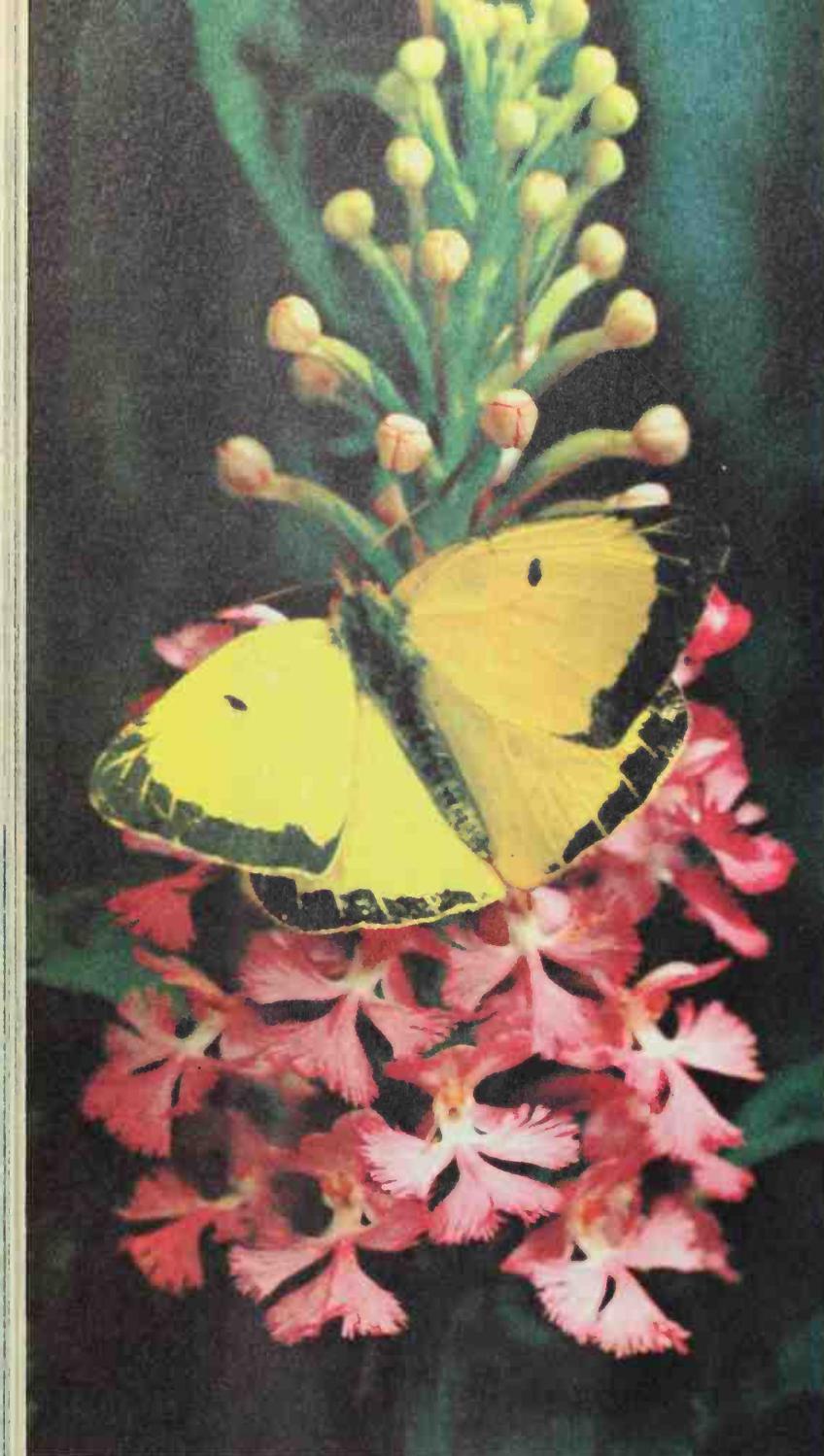
Opposite page, top: The red admiral butterfly of North America, Europe, Asia, and Africa. Its larvae feed on hops and nettles.

Center: A blue Lycaena butterfly. Members of this group are found in temperate regions.

Bottom: A European swallowtail.

Right: A Pieris butterfly, related to the white cabbage butterfly. The larvae of this group feed on cabbages and turnips.





In the balance of nature there is an exchange between plants and insects. The butterfly, attracted by a flower's color, lights on it to gather pollen or nectar as food. To suck the nectar from a flower, the butterfly unrolls a long tube from its mouth. Some of the grains of pollen stick to the butterfly's body. These are carried to another flower and pollinate it.

leaf. Many insects have markings like the bark of a tree. Some have the coloring of grasses or the soil and become almost invisible. This ability to blend into the

landscape is called protective coloration or camouflage.

Some harmless insects fool their enemies in another way. They take on the exact coloring of bad-tasting or poisonous insects that insect-eating animals have learned to leave alone. This ability to hide behind another insect's coloring is called mimicry.

THEY KNOW WHERE THEY ARE GOING

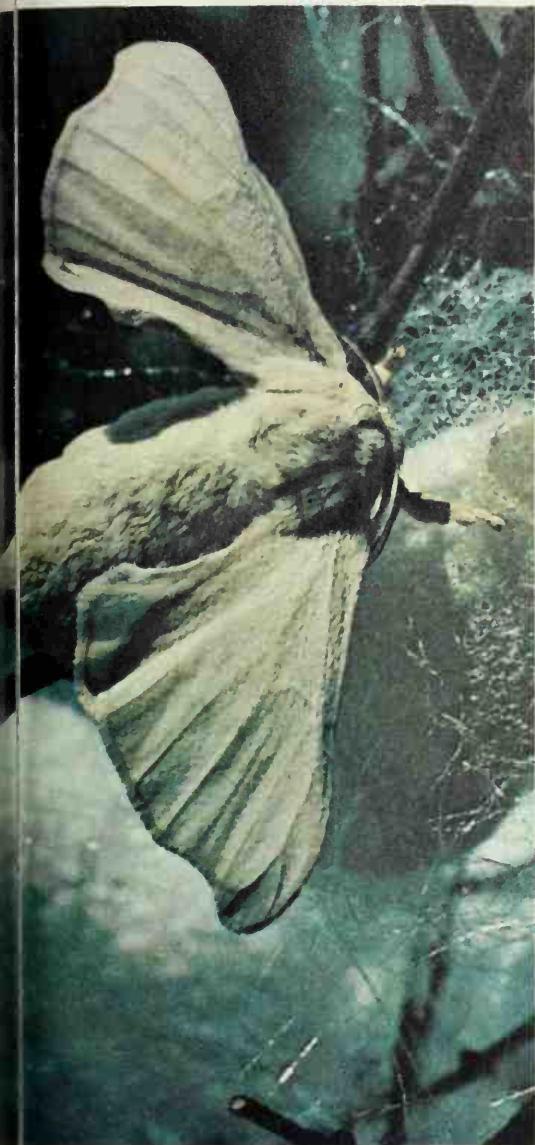
Young people love the winter when they can have fun in the snow. But many of our friends don't like the cold. I'm sure all of you have seen flocks of birds flying in formation as they look for warmer climates.

Butterflies as well as birds are fine fliers. They can perform aerial acrobatics that a stunt flier would love to copy. But would you believe that these light and graceful creatures can cover long distances? Some species of butterflies, like the birds, migrate in search of warmth.

The lovely orange and brown monarch butterfly leaves Canada every fall to fly thousands of miles southward. Great swarms of them reach the Gulf of Mexico and even farther south. They spend the winter resting quietly in the sun.

In the spring they start the long journey back again. As they travel the females lay their eggs on the milkweed plants. The eggs eventually develop into butterflies, who also fly north. Many of the older butterflies do not survive the long journey, but the strong, young butterflies carry on the pattern of migration.

Many of these migrations are made over large bodies of water. Another species, the painted-lady butterfly, flies across the Mediterranean Sea, all the way from

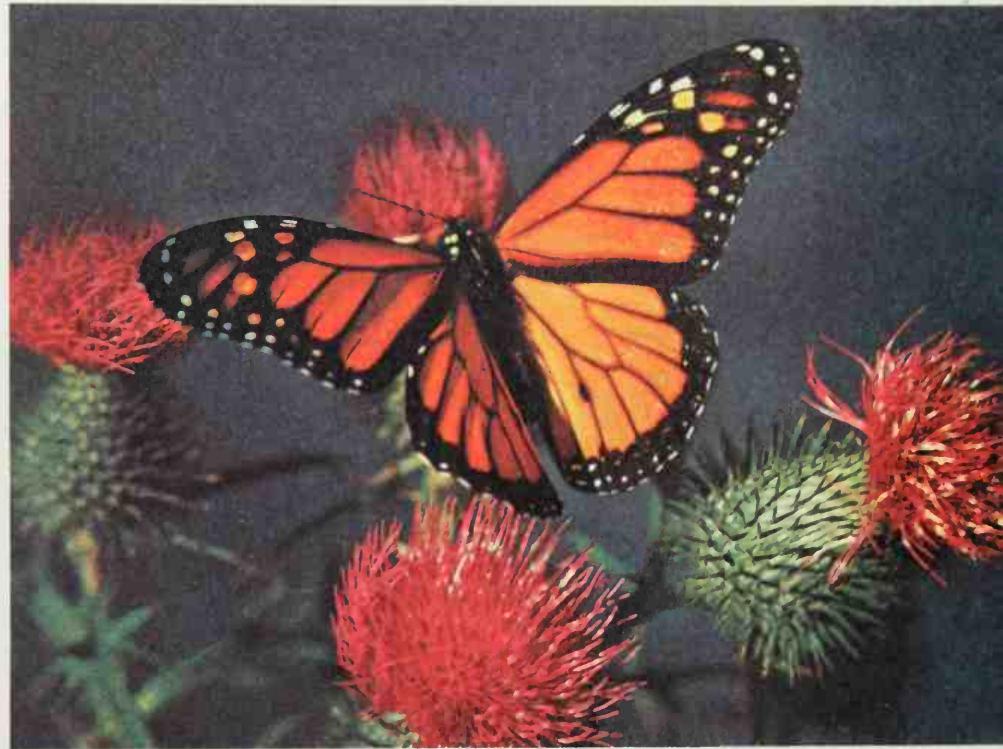


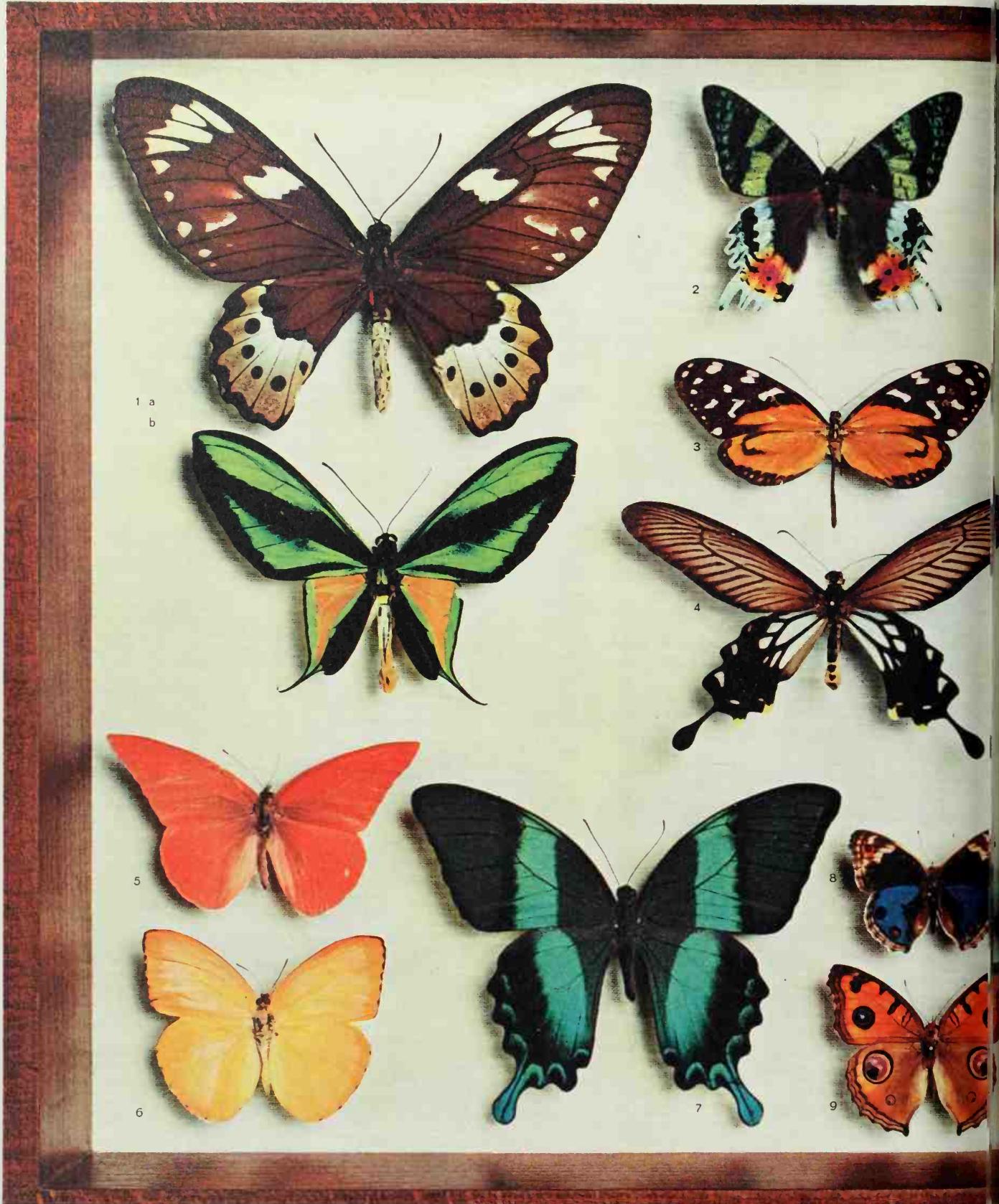
Above: The white silk moth, whose fat white larvae (known as silkworms) spin silk fiber. Because they have been fed by man for thousands of years, silk moths have lost the ability to survive in nature.

Right: A monarch butterfly lighting on a thistle.

North Africa to Britain or central Europe. It makes the long return journey in the fall.

The migrating butterflies travel in huge numbers. Sometimes millions of them fly together, following the same route year after year. What a sight it is at night when they settle on trees and cover the branches in a cloud of color.





Examples of some of the most beautiful exotic butterflies: (1) *Papilio meridionalis* (New Guinea), (a) female (b) male (2) *Urania riphoeus* (Madagascar) (3) *Melianea messatis* (Colombia) (4) *Papilio coon* (Java) (5) *Pieris zarinda* (Celebes) (6) *Catopsilia argante* (Guyana) (7) *Papilio blumei* (Celebes) (8) *Precys orithya* (India) (9) *Precys almana* (Ryukyu Islands) (10) *Papilio agestor* Gray (India) (11) *Sephsa princeps*



(Tibet) (12) *Helicopis cupido* (Amazon Basin) (13) *Hypanartia kefusteni* (Venezuela) (14) *Morpho anaxibia* (Brazil) (15) *Ornithoptera priamus* (New Guinea) (16) *Actias luna* (South America) (17) *Endaemonia brachyura* (Sierra Leone) (18) *Alphaea* sp. (India) (19) *Euchromia* sp. (Africa) (20) *Erasmia chinensis* (China) (21) *Catagramma mionina* (Colombia) (22) *Eumaeus atala* (United States).



A grasshopper. The mouth parts of this insect are formed for chewing. Under certain conditions grasshoppers may travel in swarms, doing great harm to vegetation.



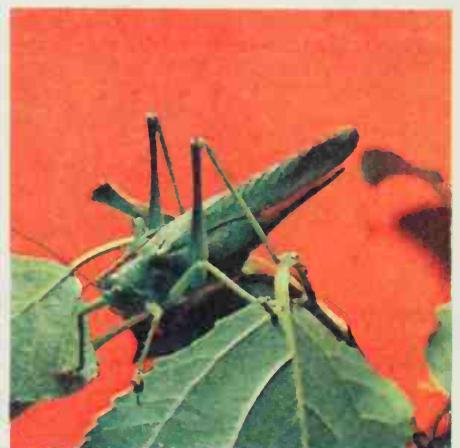
THE DRAGONFLY

The dragonfly holds the insect speed record. With those beautiful, transparent wings it can whiz by at 60 miles an hour. While in flight it can sight and catch other insects that it devours with its strong and well-developed jaws.

Don't try to sneak up on the dragonfly. It escapes so fast you would think the insect had eyes in the back of its head. And maybe it can see behind itself with those two big, bulging compound eyes.

A dragonfly like most insects has three simple eyes and two compound eyes. The simple eyes don't help the insect to see, but they do help it to tell the difference between light and dark.

A compound eye has many lenses, or facets. Each lens gives the insect a little bit of the picture that you can see all at once. The more lenses, the more the insect can see. The dragonfly has more than 25,000 lenses in each eye. No wonder it sees so much!



Left: A meeting between two deadly enemies, the ordinary black ant and the red warrior ant. The red ant invades other anthills and carries away the eggs. When they develop, they are raised as slaves.

Top: A mosquito. Its sharp, hollow stinger is clearly visible.

Above: A katydid. This green grasshopper produces its cry of "katy did" by rubbing its wings together.

GRASSHOPPERS AND LOCUSTS

You know that Grandma Duck isn't so fast on her feet these days. That's why I admire the fancy footwork of the high-jumping grasshopper. I've seen one of

them leap over a distance of 3 feet. The long hinged back legs give them all that power.

Not all grasshoppers are content to jump around in the grass and live by themselves. In the same family as grasshoppers are insects called locusts. And when locusts get together they can cause an unbelievable amount of damage.



A rhinoceros beetle of South America, named for the unusual horn on its head. Most of the members of this group are a shiny dark brown.

Locusts travel together in swarms. Suddenly, out of nowhere, they will appear like a dark cloud. Billions of them are so closely packed that they seem to blot out the sun. Once they arrive at their destination, they swoop down in a body, as if by signal. They are wildly hungry because they eat little while in flight. They devour every bit of vegetation in sight. If they are not satisfied they will even eat wood and cloth fibers and sometimes the roof off your house.

At one time it was thought that these swarming locusts were an entirely different species from the solitary grasshopper who travels alone. But then scientists discovered that the solitary variety can be stimulated under certain conditions to change its usual habits, and even its size and coloration. The climate, the degree of temperature, or a shortage of food act





Left: A crane fly, or daddy longlegs. This insect, with transparent wings and long legs resembles a huge mosquito. Some crane flies are harmful because their larvae feed on useful plants.

Top: A cicada. Its buzzing song is produced by a drumlike organ in the abdomen of the male.

Center: A goliath beetle of central Africa. The largest of these beetles is the size of a fist.

Above: A field cricket. Its cheerful chirping song is a familiar sound.

like a starting gun. The sight of others joining in also acts as a trigger.

It is a good thing that only a few species of grasshoppers can behave like this. Would you believe that a swarm of locusts can fly 2,000 miles and eat the grain that would normally fill the needs of a fair-sized city for 1 year!

The grasshopper also has some very cheerful cousins. Those noisy little fellows, the cricket and the katydid, are pleasant company. But sometimes you can't hear yourself think when they are around.

The chirping of the cricket and the rasping sound of the katydid in the trees do not come from a voice box. No insect has a voice.

Crickets, katydids, and grasshoppers

make sounds by rubbing two parts of their bodies together. Some of them rub a hind leg against a hard part of the abdomen or a rough part of the front wing. Some of them rub overlapping wings together.

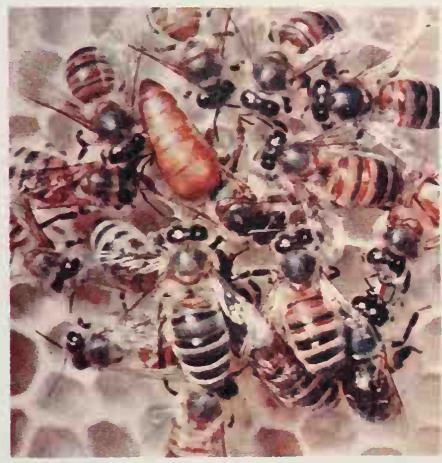
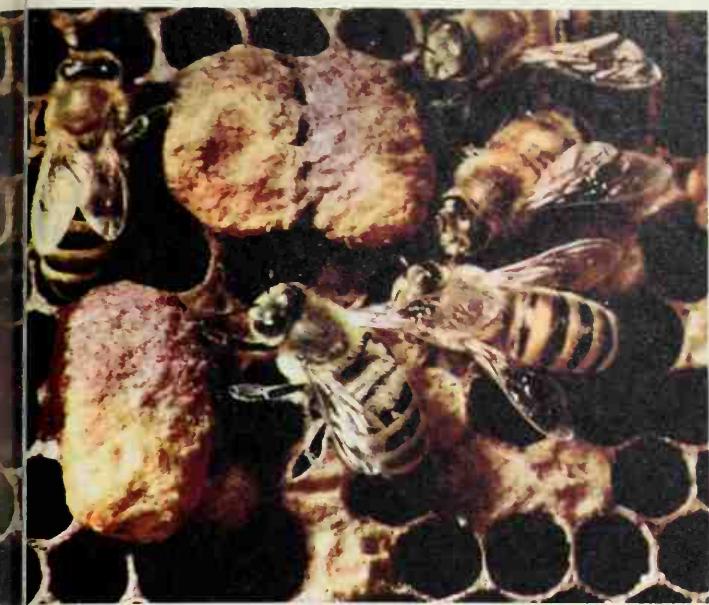
In almost every case, only the male insect can make any sound. I'm glad that's not true of ducks. You know Grandma can never keep still. And besides, who would tell you all these stories?

FRIENDS AND ENEMIES OF MAN

There's my good friend the ladybird beetle. It is usually called ladybug. In many countries children sing songs to it and always let it go free.

An ant lion. This transparent-winged insect digs funnel-shaped traps for its prey (chiefly ants) in sandy places. It loosens the sand with its abdomen and pushes it away with its head, then waits at the bottom of the trap for a victim. One very large ant lion of North Africa is able to move almost a ton of earth in 3 months.





Above, left: Worker bees in the hive. A large hive may contain 80,000 bees.
Above, right: A forager bee sucks nectar from a honeysuckle flower. Forager bees take nectar and pollen to the hive, build the honeycomb, feed the young, clean the hive, fan it to ventilate it, and guard the entrance.
Far left: A worker bee and eggs.
Left: The queen bee attended by workers. They lick a substance from her body and pass it on to others, announcing that their queen is well.



There is a good reason why we never want to harm this insect. The ladybug is a real helping hand. It eats many insect pests that attack and destroy plants.

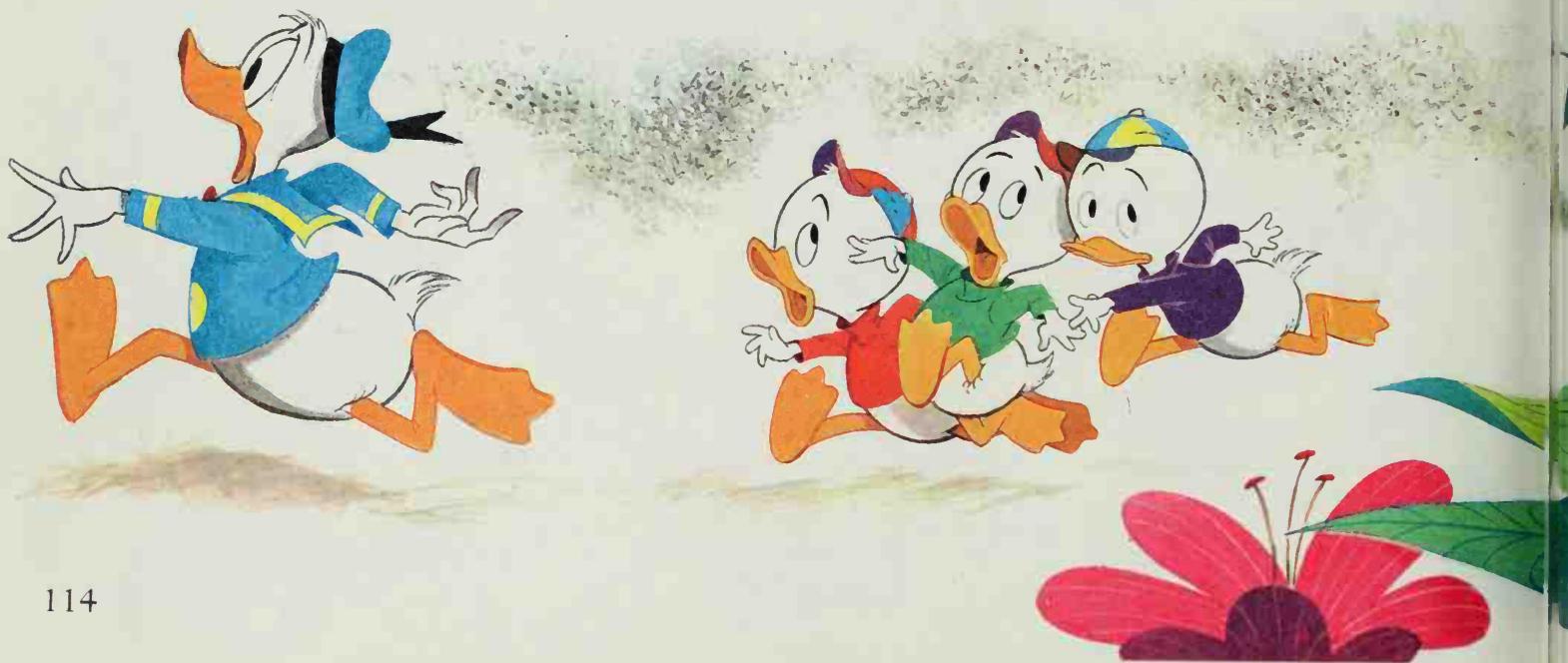
I wish I could say the same for some other beetles. The Japanese beetle, for instance, is a terrible pest. It feeds on the leaves, fruit, and flowers of plants. This beetle originally lived in Japan. It hitch-hiked over here on plants and has multiplied in great numbers ever since.

We must never forget the many things that insects do for us. The bees give us honey and wax. The silk worms spin fine silk threads. If it were not for insects carrying pollen from flower to flower and from tree to tree, we would not have such brightly colored, sweet-smelling flowers or such fine fruits.

As you see the insect world gives us both friends and enemies. Science is seeking ways to increase the number of our insect friends and to control the number of our insect enemies.

Above: A rhinoceros beetle, named for its single horn, curved back like that of a rhinoceros.

Right: A sacred scarab, the beetle that was worshiped by the Egyptians thousands of years ago.



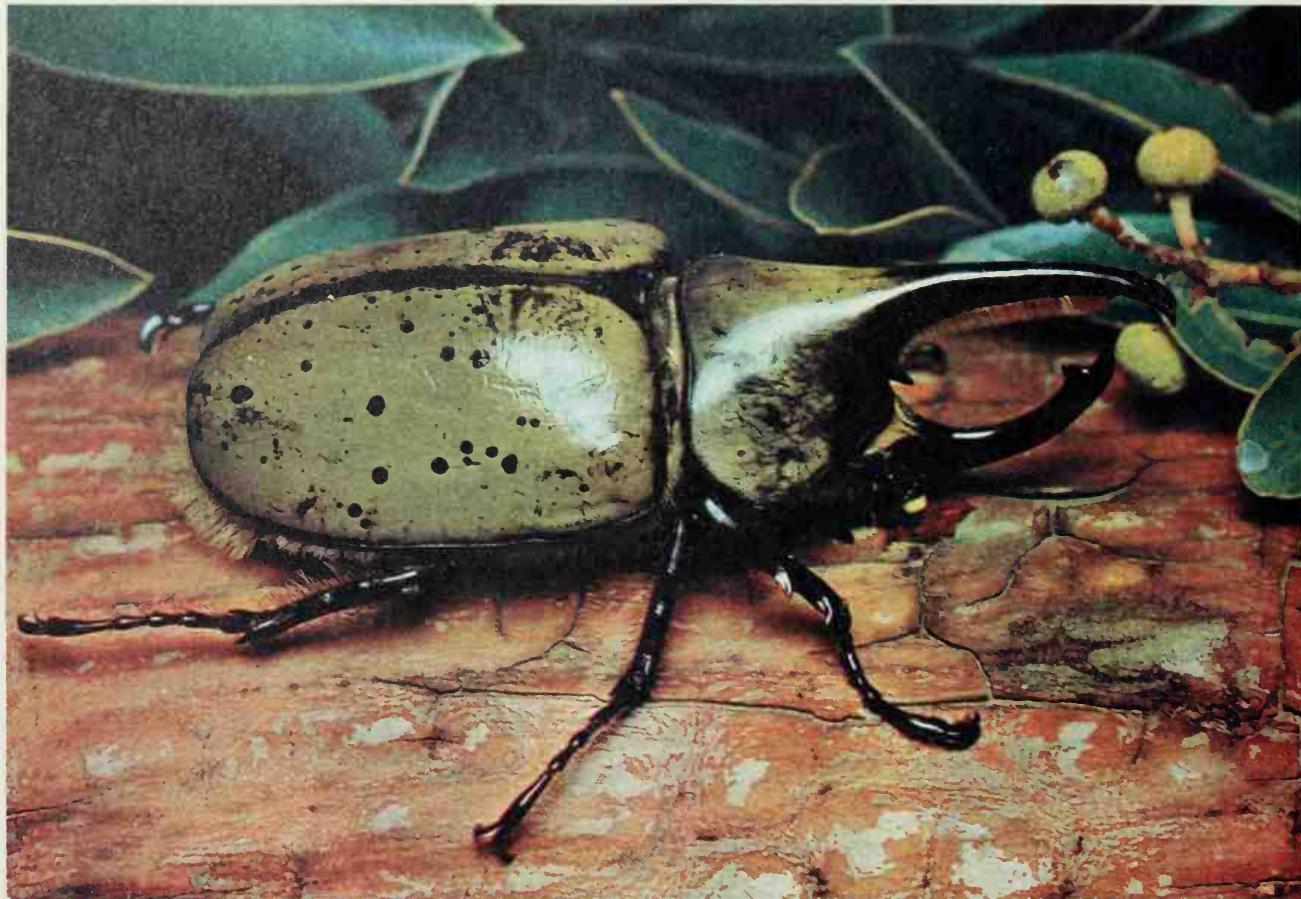
LONG LIVE THE QUEEN

The hard-working little ant sometimes makes Grandma feel as if she wastes time. Ants are social insects. They live together in a colony and are always busy. The work is divided and each ant has a task to do.

I'm sure you have seen lines of ants marching along. These are the worker ants and they cooperate in keeping the colony going. Some workers gather food; others care for the young. Some workers enlarge the nest and care for it; others defend it.

Above: A hornet. This buzzing insect belongs to the same family as wasps and bees. Hornets live in colonies, building a nest of wood fibers chewed and mixed with saliva. Inside the nest the combs lie one above another in rows. The queen lays her eggs in the cells of the comb, and workers feed the larvae. Below: The eye of a fly, greatly enlarged. This is known as a compound eye and is made up of thousands of facets, or lenses. The fly has two compound eyes, one on either side of its head.





Within the nest the queen, who founded the colony, spends all its time laying eggs. After a larval stage, many eggs develop into the wingless worker ants. Future queens and most males have wings.

At certain times of the year the future queens and the winged males fly out of the colony on their marriage flights. The male ants die after mating. The queen chews or pulls off its wings, which it will never need again. It looks around for a suitable place where it can lay its eggs and start a new colony.

ARTISTS AND SPOILERS

You know what good care Grandma Duck takes of her home and garden. Imagine how bad I felt when I saw that part of my picket fence had fallen down. When I pulled a piece of wood out of the ground, I couldn't believe my eyes.

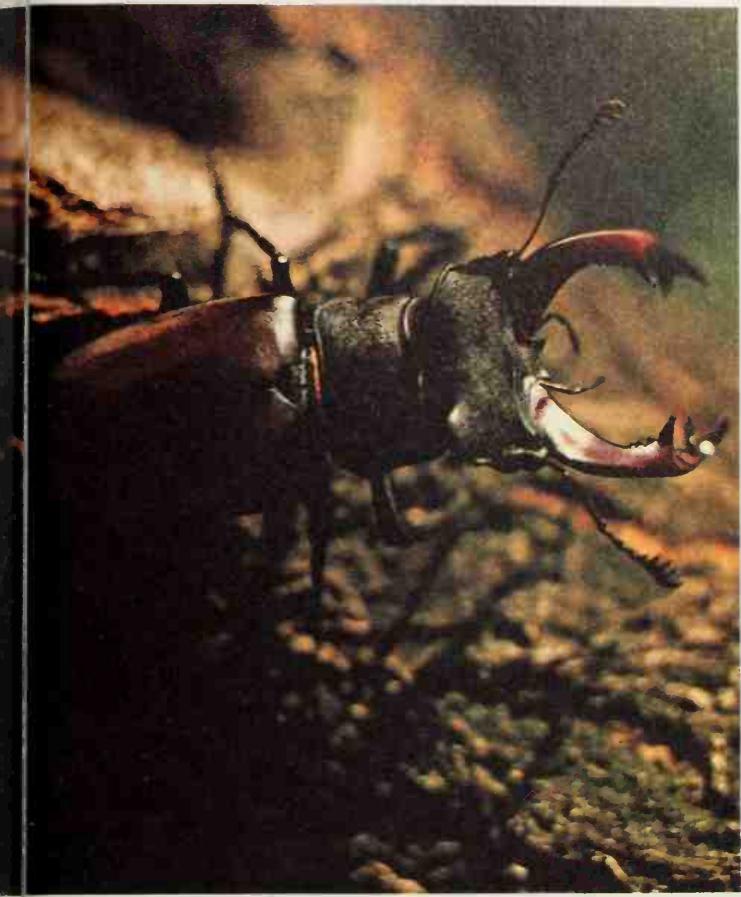
Above: A Hercules beetle, the biggest of all known beetles, and the prize of collectors. It is found in tropical America. A male Hercules beetle may reach a length of nearly 8 inches. Its larvae develop in rotting wood inside old tree trunks. Opposite page: A stag beetle of central Europe. This insect has well-developed jaws that look like the antlers of a stag. In ancient Rome the head of the stag beetle was regarded as a powerful charm.

It looked like a piece of sculpture!

Even though I was angry, I couldn't help but admire the pretty pattern of tunnels cut through and through the wood. My goodness, the insects that made that design were real artists!

It was a colony of termites that had been busy at my picket fence. Termites, like ants, are social insects. Although termites are sometimes called white ants, they are really not related to ants except that they are all insects.

It is not only the queen who starts a new termite colony. A king works right



along with the queen, and they may live together for as long as 10 or 12 years. Most of the termites in a colony are workers. The broader and larger termites are soldiers.

Termites attack a number of materials. They can digest wood, paper (look out for your books!), and have even been known to chew ivory. Be sure to keep them away from your antique furniture. They adore old wood.

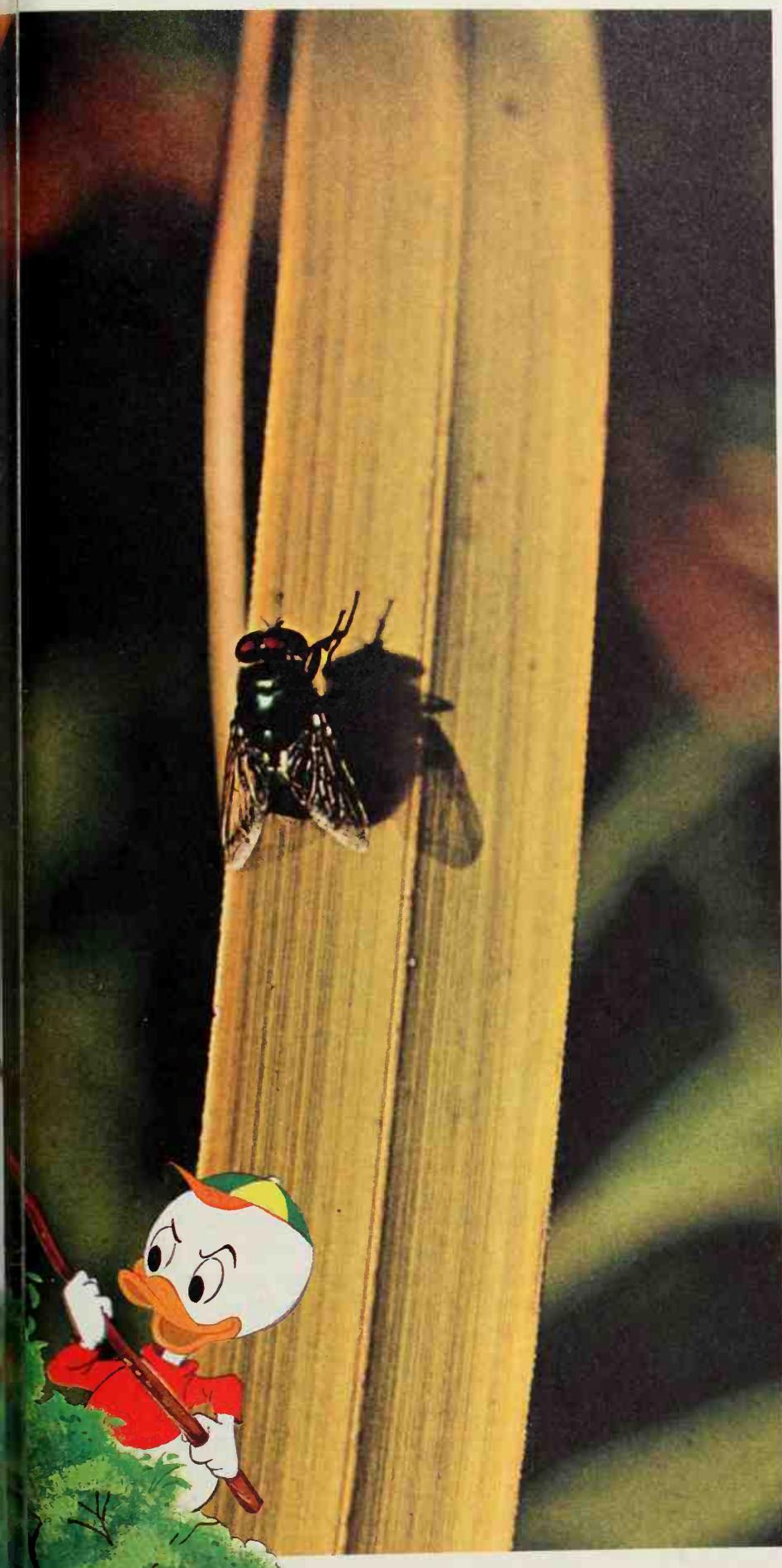
The engraver beetle is another artist. You might find the lacy tracings made by these fellows behind the bark of a tree. It is the young beetles in their larval stage as well as the adults that bore through the wood and make the designs. Fortunately for us, many of the engraver beetles work only on dead trees. But you children might remember that if you cut the bark of a tree, the fresh wound can attract these spoilers.





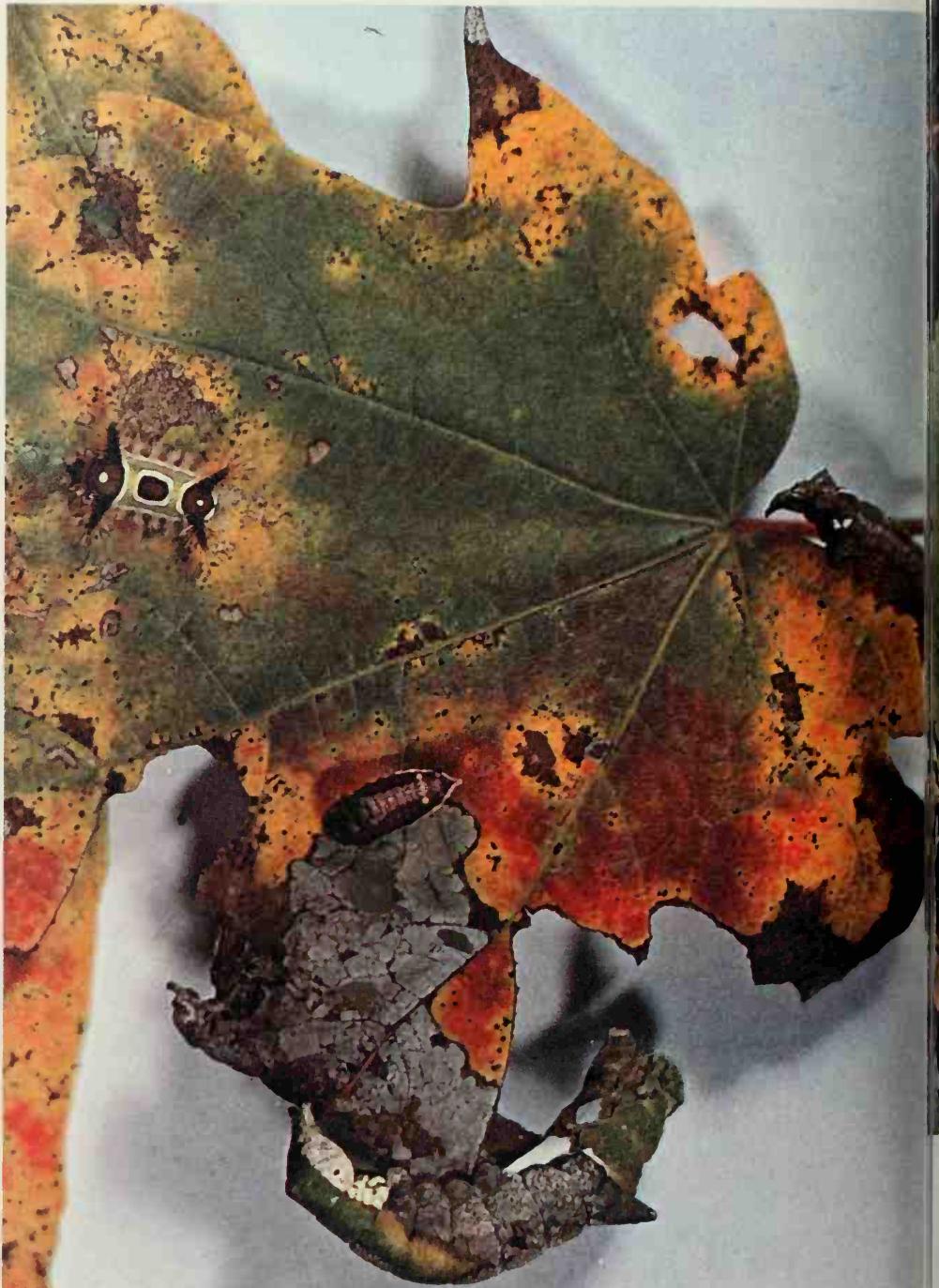
A dragonfly, member of a large group of insects with long bodies and transparent wings. Fossils of dragonflies, millions of years old, have been found.





Left: The common housefly, found all over the world. This fly does not bite, but it can be dangerous because it can carry disease germs on its feet from a source of infection to a community's food and water supplies. Flies breed in huge numbers and adapt easily to any environment.

Above, top to bottom: A blowfly (often called a bluebottle) on a leaf; a horsefly; and two flies eating sugar. Horseflies can pierce the skin and suck the blood of human beings and animals.



Some insects blend into their surroundings so completely that it is difficult to see them. This method of disguise is called camouflage. It is one of the secret weapons insects have to protect themselves from capture by their natural enemies.

Left: With its camouflage of dark green and yellow stripes, the caterpillar of a pine moth can move freely among the pine needles.

Above: The caterpillar on the lower edge of the leaf carries out the shape and color of the leaf so perfectly it seems a part of it.

Opposite page: A leaf insect of the Seychelles Islands. Its body is flat and strikingly like a leaf in appearance. The wings, antennae, and legs are all leaf-shaped too. The insect's color varies from wine red to grass green, with shadings of brown. During the daylight hours it is absolutely still—so still it might be a dead leaf on the ground. With the coming of darkness, it starts to move, and during the night it moves about freely.



Ambrosia beetles too can be quite harmful to trees. One variety of the ambrosia beetle bores away only in beer or wine casks. I wonder how he stays sober enough to do his work.

These artist fellows make their meals out of the materials they attack. But many insects prey on other insects and grab their food in rather violent ways. It is often the hungry young insects that are the most violent.

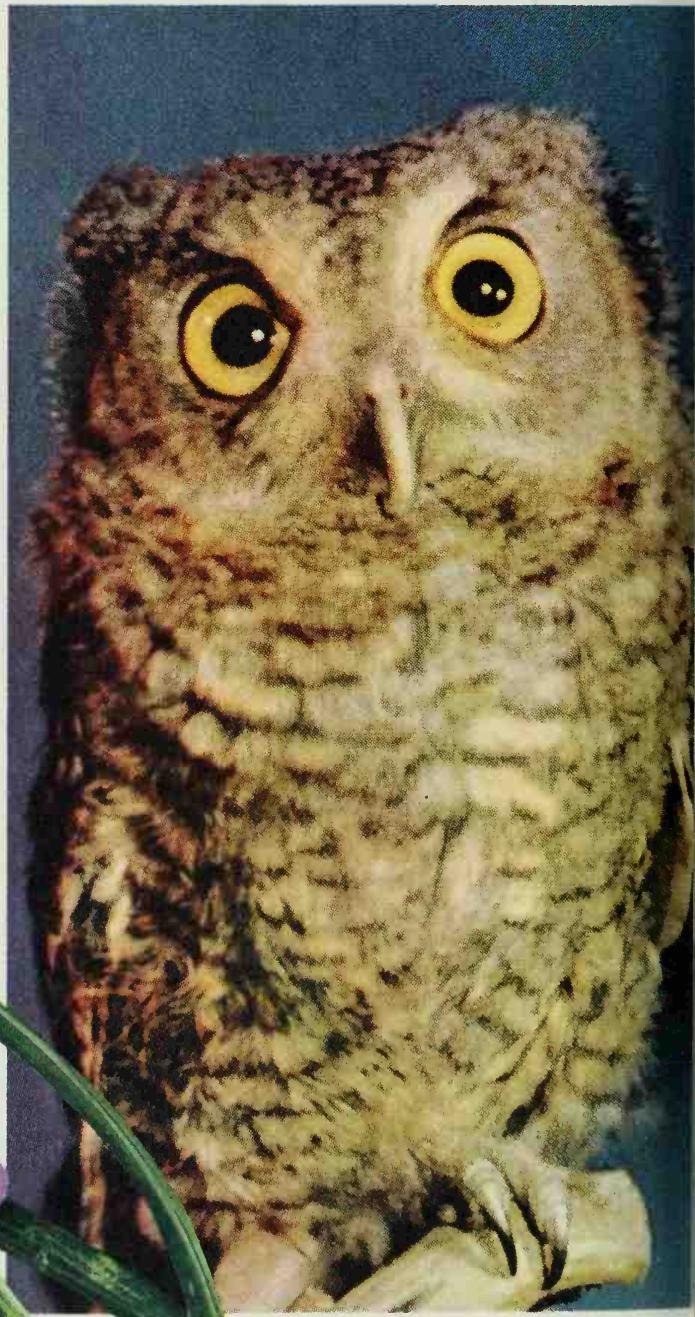
The tiger beetle is an example. You can find these slender, quick insects all over the world. Many have iridescent colors in shades of blue, green, or orange.

Some of them who live on the beach are sandcolored to match their surroundings. The adult tiger beetle is often seen where there is bare dirt. Here it scurries around looking for other insects to gobble up.

The young tiger beetle in the larval stage is very sly. It hides in a burrow of dirt with only its head exposed. When another insect passes by, the head and even a little of the body of the larva comes out like a flash to grab the victim. The larva has a pair of hooks to secure itself in its hole, so that it cannot be dislodged even if the victim should struggle very hard.



Insects are excellent imitators. Imitation is one of the ways they protect themselves from their enemies. Camouflage—blending into their surroundings so that they can scarcely be seen—is just one kind of imitation. Some insects take on the appearance of another animal. This kind of imitation is called mimicry. The owl moth (opposite page) of South America provides an interesting example of mimicry. The markings on the lower part of its wings look like the two big eyes of an owl (below). When the wings are folded and the moth is at rest, the design cannot be seen. But when the moth is threatened by an enemy, usually a bird, it unfolds its large wings, and the two eyes suddenly appear like the eyes of an owl. Frightened, the enemy flies away.





A LESSON FROM THE BEES

Now we come to the only insect that produces food for man. I'll bet you thought that I had forgotten all about the bees. No one who loves sweets as much as I do could overlook the honeybee.

There are both social and solitary bees. Of all the social bees, the honeybee has the most organized society. A colony of honeybees is headed by the queen. The queen bee lays eggs from early spring to the end of summer. During its lifetime of about 5 years, it may lay as many as 100,000,000 eggs.

The males of the colony, the drones, have only one function—to fertilize the eggs the queen lays. Female bees, all smaller than the queen, are the workers. One of their most important tasks is to

collect the pollen and nectar from the flowers to supply the hive. The pollen provides protein for the bees. The nectar, the sugary liquid in flowers, is stored in open cells where it will dry into honey.

Bees that have found a rich supply of nectar return to the hive to tell the others the good news. They perform a kind of dance, which tells the other bees the distance and location of their find.

Worker bees who attend the queen bee lick a substance from its body. They pass this substance from one to another as an announcement that the queen is well. Should the queen die or disappear, the news would be quickly passed around. The bees would then find a new queen.

I hope you children who play so well together will take a little lesson from these bees. If you cooperate and help each other, you too can build a good society. Thank you for coming with me on this trip. With much love, always, Grandma Duck.

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